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A BOYHOOD PORTRAIT OF WILLIAM STEWART HALSTED (1852-1922)

ALFRED BLALOCK

The family of the man who is regarded by many as the most distinguished surgeon America has produced can be traced back to the sixteenth century in England, where it occupied an estate in Rowley Parish called High Halsted. Timothy Halsted, from whom Dr. Halsted descended, emigrated to this country in 1660, settling in Hempstead, Long Island, and moving later to Elizabethtown, New Jersey. One of Timothy Halsted's sons was William Mills Halsted (grandfather of Dr. Halsted), who founded the firm of Halsted, Haines and Company, wholesale importers of dry goods. The firm was quite successful, and its founder became interested in various philanthropic activities including the welfare of the New York Hospital and its patients. He built a large residence at Fifth Avenue and 14th Street and subsequently added two adjoining houses for his children. One of his sons was a physician and surgeon at the New York Hospital, and another was William Mills Halsted, Jr. (father of Dr. Halsted), who followed his father in business and became the head of Halsted, Haines and Company. He married his cousin, Mary Louisa Haines, and they had four children: William Stewart (the surgeon); Minnie (later Mrs. S. O. Vander Poel); Richard; and Bertha

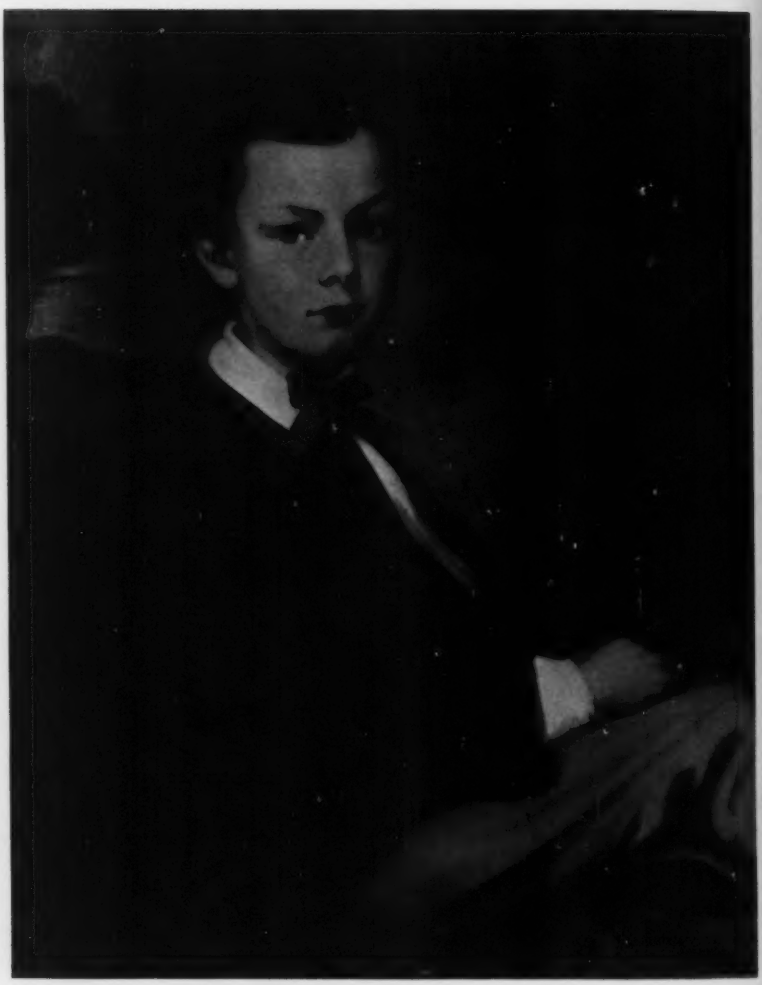

FIG. 1. William Stewart Halsted, about 1860.

(later Mrs. John T. Terry). As was true of Dr. Halsted's grandfather, his father became an influential citizen of New York City. He was a member of the Board of Trustees of the College of the City of New York, of the College of Physicians and Surgeons, and of various charitable foundations. He was the founder of the Commonwealth Fire Insurance Company.

William Stewart Halsted, the oldest of the four children, was born in New York City on September 23, 1852. His wealthy family had a town house in New York and a country home in Irvington where his father derived great pleasure from the cultivation of flowers. Young Halsted was taught at home by governesses until he was ten years old, and it was probably during the latter part of this period that the portrait was painted.

I learned in 1955 of the existence of this portrait from a surgical colleague, Dr. Beverly Chew Smith of New York. He is a friend of Mr. John T. Terry, son of Mrs. Bertha Terry and a nephew of Dr. Halsted. Mr. Terry informed me several years ago that he planned to will the portrait to Johns Hopkins. More recently he and his sister (Mrs. Mary Terry Savage) decided to give the portrait of Dr. Halsted (Fig. 1) and a photograph of the group portrait (Fig. 2) to Hopkins at this time. For this generous gift, we are very grateful. The following paragraphs were contained in a recent letter from Mr. Terry:

"The portrait was painted about 1860 (artist unknown) when Mrs. Vander Poel (Minnie) was four years old and my mother (Bertha) probably not born. The Halsted family built a house at Irvington-on-Hudson and lived there from early days until the house was sold in the 90's. The big family portrait hung there. My sister (Mrs. Savage) and I both recall having seen it there on the wall. Somehow when the house was sold Mrs. Vander Poel came in possession of the portrait and we are of the opinion that it was never hung again.

"Mrs. Vander Poel talked to us explaining that she was tired of paying storage and that nobody in her family could use the portrait. Mrs. Terry then had the idea of cutting it up to which Mrs. Vander Poel agreed. Three portraits were made out of the original. We kept the portrait of Uncle Will and it hung over our fireplace.

"I originally planned to leave it to Johns Hopkins in my Will, but after talking to my sister we decided it would be better to turn the portrait over at once, largely because of your great interest in the portrait and in the Halsted room."

FIG. 2. Mrs. William Mills Halsted (Mary Louisa Haines) and three of her children: William Stewart Halsted (seated), Richard Haines Halsted, and Minnie Halsted.

The beautifully framed portrait of Dr. Halsted as a youth and the photograph of the group portrait are now hanging in the Halsted Memorial Room on the sixth floor of the Clinical Science Building of the Johns Hopkins Medical School and Hospital. This room contains some of Dr. Halsted's furniture and many of his other personal effects and was decorated through the generosity of his nephews, John T. Terry and William Halsted Vander Poel, and his niece, Mary Terry Savage.

A SURVEY OF SOME BRITISH VETERINARY FOLKLORE

T. D. DAVIDSON

The traces of folk beliefs in veterinary science and practice are disappearing so rapidly that the subject is becoming of historical interest only. The history of veterinary medicine as a discipline distinct from human medicine begins in the period from the late eighteenth century to the formation of the various schools at, for example, London in 1791 and Edinburgh in 1823. It was not until the foundation of the Royal College of Veterinary Surgeons in 1844 that the profession received formal recognition. Prior to this animal care and treatment was almost entirely in the hands of farriers, herbalists, gypsies, and wisemen, using traditionally sanctioned forms of folk-cures and remedies. Indeed the contemporary opinion, voiced by Fitzherbert, was that veterinary surgeons were little better than rogues.

The sources of our present knowledge of early folklore and veterinary data consist of chronicles, histories, court and manor rolls, records of trade guilds, Anglo-Saxon magical and medical texts, including herbal and animal medicines, and a wide variety of collectanea comprising diaries, stillroom and everyday books. This paper is concerned with the folk beliefs associated with the means adopted for safeguarding against and curing disease in farm animals. An analysis of the material shows that it falls into two broad groups—charm cures and amuletic cures. The distinction, however, lies not so much in the material of the cure but in the method by which it is applied. The word charm, Latin *carmen*, means the chanting or recitation of a verse supposed to possess magical power or occult influence, i. e., a spell. It has, however, a secondary significance denoting material things credited with magical properties, worn on, or in close association with, the object which it is designed to protect. The amulet belongs to this secondary classification of the physical charm. The words charm and amulet have thus a very wide connotation, and although they do not permit of a simple and rigid definition, it is sufficient, without qualification, to define them as follows. A charm operates indirectly and is usually expendable, while an amulet is permanent and operates directly, usually by contact.

We propose, in order to clarify the treatment and permit a simple

classification, to divide the two main categories of charm and amulet cures into the following groups:

1. Charm Cures consisting of remedies and prescriptions in the form of chants, pagan, and christianised-pagan prayers.

2. Charm Cures where the active ingredients are herbal and natural elements such as salt, water, and soot.

3. Charm Cures deriving from the belief in magical transfer and propitiation.

4. Amuletic Cures employing natural objects such as naturally holed flints and stones, rock crystal balls, and pebbles.

5. Amulet Charms employing manufactured objects such as coins, ornamental pendants, prehistoric artifacts, and various assortments of wool, wood, and threads.

The ritual practices which go to make up these groups stem from the early belief that nature was activated by spirits. The use of magic and semi-religious ritual may, therefore, be regarded as a primitive technique directed at the control of the unseen spirits by sympathetic magic involving the power immanent in similarity, transfer and imitation, and propitiation by means of sacrifice.

1.

Pagan and christianised-pagan chants, invocations, and designed prayers, used as curative and prophylactic charms, appear from their distribution to be concentrated in the north of Scotland and Ireland with a few scattered examples in England. In the north west of Scotland, the " cow-doctor " had the choice of two charms in the form of an incantation for curing " red-water," also known as " red-swelling," " red-disease," and " red-murrain." The ailment was attributed to the eating of sun dew.

In making the incantation, the " doctor " cups his hands and collects some of the urine from the infected cow. He throws the urine into running water, washes his hands, and forms them into a trumpet. Facing the rising sun, he intones the following " Incantation of the Red Water " through the trumpet as loudly as possible:

In the name of the Father of love,
In the name of the Son of Sorrow,
In the name of the Sacred Spirit. Amen.

Great wave, red wave,
Strength of sea, strength of ocean,

The nine wells of Mac-Lir,
Help on thee to pour
Put stop to thy blood
Put flow to thy urine.
(Name of animal).

Alternatively, the "Red Water Charm" could be used:

I am now on the plain,
Reducing wrath and fury,
Making the charm of the red water,
To the beauteous black cow.

For milk, for milk substance, for milk produce,
For whiskered whey, for milk riches,
For curdled milk, for milk plenty,
For butter, for cheese, for curds.

For progeny and prosperity,
For rutting time and rutting,
For desire and kine,
For passion and prosperity.

The nine wells of Mac-Lir,
Relief on thee to pour,
Put stop to thy blood,
Put run to thy urine,

Thou cow of cows, black cow.
Great sea, red cascade,
Stop blood, flow urine.[1]

In cattle and horses, the symptoms of yawning and vomiting and a general disturbance of the system were usually attributed to the evil eye. The charm for removing the effects was handed down from male to female, from female to male, and was efficacious only when thus transmitted.

Before pronouncing it over the sick animal, the 'cow-doctor' goes to a stream over which the living and the dead pass, and, in the name of the Holy Trinity, bails water into a wooden ladle. (In no case is the ladle of metal). A wife's gold ring, a piece of gold, silver, and copper are put in the ladle. The sign of the cross is then made, and the following rhyme is repeated in a slow recitative manner—the name of the animal under treatment being mentioned towards the end.

Who shall thwart the evil eye?
I shall thwart it, methinks,

[1] A. Carmichael: *Carmina Gadelica*, vol. 2. Edinburgh: Constable, 1900, pp. 120-3.

In name of the King of Life
Three seven commands so potent,
Spake Christ in the door of the city;
Pater Mary one, Pater King two, Pater Mary three, Pater King four,
Pater Mary five, Pater King six, Pater Mary seven,
Seven pater Maries will thwart
The evil eye
Whether it be on man or on beast
On horse or on cow
Be thou in thy full health this night
(Name of animal)
In the name of the Father, the Son and the Holy Spirit. Amen.

Some of the consecrated water is then given as a draught, and some is sprinkled over the head and backbone of the beast. In the case of a cow, the horns and the area between the horns are carefully anointed. Occasionally a woollen thread, generally of the natural colour of the animal, is tied round the tail.

The remnant of the water, no drop of which must have reached the ground, is poured over the threshold flagstone. The skilled " cow-doctor " apparently could distinguish whether it was a man or woman who had caused the sickness—if a man, the copper adheres to the bottom of the upturned ladle, if a woman, only the silver and gold adhere.[2]

For loss of milk from the same cause, there were many rhymed chants and degenerate prayers. Some were simple chants, others were complicated and lengthened by the inclusion of restricting conditions regarding time and place and also the introduction of additional elements, such as special water, herbs, and plants. In the two fairly representative examples which follow, the first is a simple chant, and the second is a christianised version of a magical (sympathetic) ritual.

When you make a beginning
Put a good handful of salt in it.
Put root and flower of the daisy in it.
Put the entrails of a seal and a hare in it.
Cut a wand of rowan over from the face of Ellasaid.
A red thread with a tight knot
Put on the head of the churn staff
And should the witch Hendry (of Endor) come
The boy would conquer her.[3]

In the second example, the following procedure was adopted. When-

[2] *Ibid.*, pp. 42-3.
[3] R. C. Maclagan: *The Evil Eye in the Western Highlands.* London: Nutt, 1902, p. 96.

ever a cow calved, the calf was immediately removed before it could draw milk from the cow. Milk was then drawn from four teats into a bottle, the person so doing kneeling on one knee, saying:

May God bless these cattle folds this I am asking in the name of God, nor am I asking but for mine own.

The bottle was then tightly corked and hidden in a safe place.[4]

As a general specific for diseases of all kinds, the following charm, attributed to St. Columba, was chanted over the animal:

A foot in the sea, a foot on land,
Another foot in his boat
For worm, for swelling,
For red sickness, for colic,
For colic that is in thy belly
For that rock over there
A rugged crag that there is there
(Name of beast)
Health to thee, O beast![5]

2.

The material in this group is made up of simple recipes consisting of a confusion of magical herbs, common herbs, and substances used magically, that is, in association with odd scraps of formulae, to be used at certain times and under certain limiting conditions. For example, to cure pocks and scab in sheep:

Take Lupin and the lower part of boar-fern, the upper part of spear wort, large beans ground up; pound all together very small in honey and holy water, and mix well together. Put a dose into the mouth with a spoon, always three a day; nine times if there be great need.

For sudden death in swine—Put this always into their food. Seethe 'clite,' give to eat. Take also lupin, bishopwort and hassock, therethorn, hedgerife, haranspicel; sing four masses over them; drive them into the sty; hang the plants on the four sides and on the door; burn the plants; add incense to them; make the smoke stream over the swine.[6]

Elspeth Reoch, a wise woman of Orkney, was supernaturally instructed to cure distemper by resting on her right knee while pulling a certain herb,

[4] G. Henderson: *Survivals in Belief among the Celts.* Glasgow: Maclehose, 1911, p. 28.
[5] *Transactions Gaelic Society of Inverness,* 1878, *8*: 9.
[6] J. H. G. Grattan and C. Singer: *Anglo-Saxon Magic and Medicine.* London, New York: Oxford Univ. Pr., 1952, p. 179; and T. O. Cockayne: *Leechdoms, Wortcunning, and Starcraft of Early England.* London: Longman, Green, etc., 1864-66, vol. 3, p. 57.

" callit malefour," between " her mid finger and thombe," and to say, " In Nomine Patris, Filii et Spiritus Sancti," while she was doing so.[7] A cow-charmer in Craignish always gathered his herbs, pearlwort, fig, and moonwort, on St. Swithin's day and made his concoctions with one foot in the chimney crook. The herbs had to be plucked, not cut.[8]

The Irish recipes for curing disease follow more or less the same pattern. For the " blood-water cure "—cram two live frogs down the cow's throat, first having removed two of the frog's limbs, with six quarts of water before, and three after. If this does not effect a cure, then give her a dose of the herb called Youth or Bla na hoga with a pound of butter.[9] A Hertfordshire (England) prescription for the same complaint is to take " Pennygrass Scabious and Chamomille a little of each, a few cloves bruised or some cinnamen; boil these in a quart of old Verjuice; give a pint of this warm to a cow fasting, out of a horn; if it does not answer at first, renew it three or four mornings." [10]

The most frequently recurring ingredients, or what may be termed active elements, in a great many of these recipes are urine, salt, and soot. In parts of Scotland special virtues were attached to stale urine. Kept mainly for the purpose of scouring blankets and cloth, it was also used until late into the nineteenth century to ward off disease. There were many ways in which it could be applied, but the most common method was to dip a wisp of straw into the urine and sprinkle the cattle and byre doors. It appears also in an early fifteenth century recipe " for, peyne of hors legges," take " old vryne of a man and hene dirt and tamper it togedyr and it shall hole hyme made in a pleyster." [11]

Mention is made of the use of salt in the diary of the Rev. James Woodforde, dated February 5th, 1790:

> My Cow rather better this morning, but not able to get up as yet, she having a disorder which I never heard of before or any of our Somersett Friends. It is called Tail-shot, that is a separation of some of the Joints of the Tail about a foot from the tip of the Tail, or rather a slipping of one Joint from another. It also makes all her Teeth quite loose in her head. The Cure, is to open that part of the

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[7] J. G. Dalyell: *The Darker Superstitions of Scotland.* Edinburgh: Waugh and Innes, 1835, p. 22.

[8] J. G. Campbell: *Witchcraft and Second Sight in the Highlands and Islands of Scotland.* Glasgow: Maclehose, 1902, p. 12.

[9] D. Hyde: *Religious Songs of Connacht.* London: T. F. Unwin, 1906, vol. 2, p. 388, note.

[10] *Journal Royal Army Veterinary Corps,* 1952,*23*, 1: 135.

[11] *Ibid.*, 1952, *23*, 4: 97.

Tail so slipt lengthways and put in an onion boiled and some salt, and bind it up with some coarse Tape.[12]

Again in Yorkshire (ca. 1830) a local wiseman prescribed salt in his inscribed charm for the cure of any mysterious illness:

Bleed the sick animall and dip in amongst the Blood som hair Cut of the animals mane Tail and 4 Quarters then put in 3 Spoonfuls of Salt then have a Sheep's heart stuck with 9 new pins 9 new needles 9 small nails then rool the heart well in the blood and at 12 at night put the heart on a Good fire of Coals and ash Sticks.[13]

The following cure for a cow whose milk has dried up was commonly used in the north-west and western islands of Scotland. The "cow-doctor," on bended knee, places salt on a piece of paper. The salt is measured out with a thimble painted blue on the inside. The salt is next put into a cloth and water poured through it into a bottle. The water is then given as a drench to the cattle.[14] In South Uist, the cure for a lump on a horse was simply to cut out the lump and apply salt and water pickle, so strong that a potato will float on it, to the open wound for several days.[15]

Rather similarly, but for an unspecified complaint, a farmer in Kintyre cured a cow by bailing out water in three parts from a march burn. The first part was bailed into a bottle in the name of the Father, the second in the name of the Son, and the third in the name of the Holy Ghost. A quantity of salt was divided up in the same way and put into a bottle. To the accompaniment of a prayer to Peter, Paul, and Mary, the solution was poured in the cow's ears and over her back.[16] Finally, in the south of Scotland, the wiseman recited, "God betak us to! Maybe they are under the earth that have as much need of it as they that are above the earth," while he threw a small quantity of salt into the sewer of the cow house. After this he put wheat, bread, and salt into the cow's ears.[17]

In several counties of England and Scotland, we find the belief in the medicinal value of soot. Tusser, who lived in Essex, subscribed to the belief, and William Ellis, writing from Hertfordshire, gives a prescription for a soot drink to keep cows in good health all the year round:

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[12] *Folk-Lore*, 1950, *61*: 98.

[13] J. C. Atkinson: *Forty Years in a Moorland Parish*. London, New York: Macmillan, 1891, p. 113.

[14] Maclagan, *op. cit.*, p. 117.

[15] M. F. Shaw: *Folksongs and Folklore of South Uist*. London: Routledge and K. Paul, 1955, p. 51.

[16] Maclagan, *op. cit.*, p. 176.

[17] *Maitland Club Miscellany*, 1841, *1*: 439.

Get half a pint of fine Wood Soot and mix it with halfe an ounce of diapente and a quarter of fresh butter..The soot and the diapente must first be boiled about a Quarter of an Hour in three pints of strong Beer or Ale and when it is half cold dissolve the quarter lb fresh butter in it and when the Drink is blood warm give it to the Cow well mixed.[18]

The Arran cure for ailing horses, where the illness was thought to be brought on by the evil eye, also uses soot. In one particular case at Whiting Bay, a farmer was given three balls of soot wrapped up in paper with the strict injunction not to expose the contents to air or light until ready to use. The soot was put into a bottle of water and the water sprinkled over the horse, its name being repeated three times; some was put into each ear and the remainder mixed in with its food.[19]

3.

Cures involving transfer and ritual sacrifice are not only based on the sympathetic magical power immanent in similarity, but in themselves bear a close resemblance. The belief that disease could be transferred to or from an object is very ancient and had a wide distribution. Transfer rites may take one of two main forms: transfer of a disease from an animal to an inanimate object such as water, stone, or ground, and from one animal to another, occasionally through the agency of charm amulets.

It was common belief among farmers all over Scotland that cattle ailments of every type could be carried away and left on another farmer's land. For example, the cure in Caithness for the " heastie " a virulent form of distemper among cattle, was secretly to transport a portion of the diseased beast from the owner's ground to the ground of a neighbour. The latter's cattle sickened while those of the former recovered.[20]

A blood disorder in black cattle, known throughout Mull as the " black spauld " was thought curable by burying alive the first cow to be infected and driving the rest of the herd backwards and forwards over the pit.[21]

Rather more involved was the cure in the south of Scotland for the " routing evill " or madness, to which oxen were particularly susceptible. The directions were to take " one quick ox with one catt, and one grit quantitie of salt " and proceed to bury the ox and cat alive, with the salt,

[18] *Journal Royal Army Veterinary Corps*, 1952, *23*, 4: 134, quoting W. Ellis: *The Country Housewife's Family Companion*. London: Hodges, 1750.

[19] Maclagan, *op. cit.*, pp. 188-9.

[20] Dalyell, *op. cit.*, p. 108.

[21] J. Ramsay: *Scotland and Scotsmen in the Eighteenth Century*. Edinburgh, London: Blackwood, 1888, vol. 2, pp. 446-7.

in a deep hole, so that " the rest of the guidis might be freed of the sickness or disease." [23]

The Breadalbane cure for the same disease was to tie together the legs of one of the mad animals and throw it into a pit dug near the byre or fold door. After the hole was filled in, a large fire was kindled over it, and the rest of the animals were forcibly driven out through the fire one by one.[23]

In Lewis, a cure for liver disease in cows is recorded so late as 1890. The cure consisted of placing a black cock between the legs of the sick cow, splitting open the fowl's back, removing the heart, and putting it in water. While the fowl was still alive, the water was given to the cow.[24] And in Tiree, a farmer who had lost two or three stirks by accidental strangulation was directed to place the right-hand part of a fore horse-shoe with three nails in it under the threshold of the byre along with a silver coin, while the hind quarter of one of the beasts should be taken west and buried beyond the limits of the farm. In this way he could protect the rest of his animals.[25]

Belonging in this group was the widespread custom of pegging calves or yearlings. Up to 1900, for example, calves suffering from " black leg " in Leicestershire, or " pook " in Sussex,—a congestion of the blood vessels of the leg which causes discolouration of the flesh—were " pegged " either in the ear or the dewlap. In the former case, a hole was either punched or burnt with a red hot iron through the ear, generally on the first Friday after the birth of the calf. In the latter, a hole was burnt through both skins of the dewlap when the animal was a year or sometimes two years old.

In both cases, a twist of horsehair about five inches long was inserted through the hole and secured with a wooden peg at each end. This twist was moved backwards and forwards once a week; occasionally dressings were applied, and usually the twist was disposed of either by burying or burning.[26] It is interesting to record that the practice is still being used in some parts of Yorkshire.[27]

Cole gives the same cure for murrain:

husbandmen should cut a hole in the ear or dewlap and put therein a piece of the

[23] Records of Justiciary, Edinburgh: Trial of Isobel Young, Feb. 24, 1629.
[23] Ramsay, *op. cit.*, p. 447.
[24] *Folk-Lore*, 1895, *6*: 167.
[25] Campbell, *op. cit.*, p. 15.
[26] *County Folk-Lore*, 1895, *3*: 55-6.
[27] Private communication, 1958.

root of beansfoot which some call "pigging" or "settering." This last name may possibly account for the reason why the plant is sometimes referred to as "setterwort." [28]

The same principle underlies the following cures. In the north of Scotland, paralysis of the spine in sheep, cows, and horses was thought to be caused by the grass mouse, the "lucha sith" or fairy mouse running across the recumbent animal. The cure was to take a shrew mouse alive or dead and trail it across the loins and spine of the animal in the name of the Trinity.[29]

Variants on this, recorded also for England and Ireland, involved plugging up the shrew mouse alive in a hole in a tree and drawing a twig from the tree across the afflicted limb, or sprinkling, or giving as a drink, an infusion of the leaves and twigs of the same tree.[30] To safeguard the life of a cow when she was calving, a common Shetland custom was to place a cat on the cow's neck, draw it by the tail to the cow's hind parts, then, placing it in the middle of her back, draw it tail foremost down one side and up the other.[31]

Throughout the British Isles animals were, and have been until recently, sacrificed by farmers to avert and cure disease among cattle. Now sacrifice, unlike the other elements of charm cures and ritual, could not be ignored by the Church; it could not be dissociated from a recognition of the divine nature of the power in whose honour it took place. And it was because of this feature more than any other that the full might and authority of the Church was brought to bear in an effort to put it down as a sacrifice to the devil. For this reason it is not surprising that there should now be but few direct and evident survivals.

Reginald of Durham records that at Kirkcudbright, in 1164, St. Aelred interfered and stopped the sacrice of a bull. Numerous bulls were sacrificed at Loch Maree in the north-west of Scotland at different times throughout the seventeenth century.[32] On the 20th of January, 1651, we find Turriff Presbytery censuring the Chamberlain of Fyvie and others for trying by means of charms and new fire to cure cattle of the quarter-ill, and for burying "ane ox quick which was a reall sacrifice to the dewill." [33]

[28] *Journal Royal Army Veterinary Corps*, 1952, *23*, 3: 99, quoting Cole: *The Art of Simpling*, 1656.

[29] L. Spence: *The Fairy Tradition in Britain*. London, New York: Rider, 1948, p. 164.

[30] *Notes and Queries, London*, 1849-1850, *1*, no. 22: 349.

[31] Spence, *op. cit.*, p. 164.

[32] *Proceedings Society of Antiquaries of Scotland*, 1861, *4*: 254, 260.

[33] J. M. McPherson: *Primitive Beliefs in the North-East of Scotland*. London, New York: Longmans, Green, 1929, p. 32.

Some years later, in 1658, Michael Kynoch was " delat " before the Session of Urquhart for burying " a young ox quick because his beasts were dying, this being judged as a sort of sacrifice to Satan." [34] Late in the eighteenth century, in Lanarkshire, the father of Sir James Simpson, the discoverer of chloroform, took part as a boy in burying a live cow as a sacrifice to the spirit of murrain.[35]

In 1850, disease broke out amongst the cattle on a small farm in the parish of Resolis, in the Black Isle. The farmer consulted a " canny woman " in Banffshire about a suitable charm against the murrain. Acting on her instructions, he burnt to death a pig and sprinkled the ashes over the byre and other farm buildings.[36] In Elgin in the same year, and for the same reason, a cow was buried alive.[37] An Orkney farmer was directed by the local " cow-doctor " to select his best beast and burn it in a kiln with a roaring fire of peats.[38] A more terrible sacrifice was offered up in upper Banffshire. One of the diseased animals was rubbed over with tar, set on fire, driven forth, and allowed to run until it fell down and died.[39]

A calf was burnt to death in Cornwall about 1800 to arrest the murrain,[40] and in 1812 the farmers in a particular area of Wales " cast a captive to the devil " in the form of a live bullock which was thrown over a high precipice.[41] So late as 1866 in the north of England attempts were made to stay the spread of murrain by burning a live ox.[42]

There is still a lingering memory in the Western Isles of Scotland of a cure for a species of cattle plague which was especially destructive of heifers. If a heifer's head was struck off at a single blow with a clean or stainless knife, the plague would rapidly die out.[43]

In some districts, however, certain diseases were thought to be curable only by human blood or sacrifice. Cattle madness was one of these and a Kinlochewe farmer, it is reported, was directed to kill a man who did not know his parents, remove his heart, and dip it in a tub of water. If the

[34] W. Gammond: *The Church and Priory of Urquhart, Elgin.* 1899, p. 41.
[35] E. B. Simpson: *Folklore in Lowland Scotland.* London: Dent, 1908, p. 27.
[36] W. Gregor: *Notes on the Folk-lore of the North-East of Scotland.* 1881, p. 186.
[37] *Elgin and Morayshire Courier*, 1861, May 24th.
[38] R. M. Ferguson: *Rambles in the Far North.* 1884, p. 71.
[39] Gregor, *op. cit.*, p. 186.
[40] G. Henderson, *op. cit.*, p. 271.
[41] *Ibid*
[42] W. Henderson: *Notes on the Folk-Lore of the Northern Counties of England and the Borders.* 1879, p. 149.
[43] G. Henderson, *op. cit.*, p. 270.

water were sprinkled over the infected cattle, the madness would be washed away. The report goes on to say that although the cattle were cured, the disease was transferred to the farmer and his family.[44] In Breadalbane during an outbreak of a pestilential disease among the herds, the farmers in the district seized a beggar, bound him hand and foot, and laid him in the ford of a nearby stream. All the cattle in the infected area were then driven over his body until he was crushed to death.[45]

4.

Naturally perforated flints, pebbles, and limestones, worn, grooved, and odd-shaped stones of unusual colour, represent, because of their greater or more common availability, the most widely distributed group of amuletic cures. Although there appears to have been very little colour discrimination in the use of stones, special significance seems to have been attached to the white or opaque variety.

The Rev. Robert Wodrow, the church historian, writing from Inverary in 1702, records that he received " a cylindricall white stone, and a little stone which they call bats-stones because they heall horses of the worms they call bats." These stones found in Skye among the sands near Loch Siant were of a " finger-length and pyramid shape." They were boiled in water, and the infusion was given to horses suffering from intestinal worms.[46]

The belief in the supernatural virtues of white stones may be in part due to the fact that quartz and white pebbles were signs of acquittal, according to the custom of the Greeks. In some parts of India, the only sign that denotes a demon worshipping spot consists of three small stones of white quartz. White quartz pebbles were also placed with the dead from neolithic times onwards, and examples have been found in Welsh chambered barrows such as Bryn Celli Dhu and Pant y Saer, in Ireland in the Beyne valley near Dublin, and in a cairn, Ach na Cridhe, in Argyllshire and in many other highland areas of Scotland.

Gavin Sinclair confessed during his trial for witchcraft in 1650 that he had brought with him a stone from Ireland which he alleged had

ane secret vertue in it to cure beasts of the quarter evil, and being layd in the fold gate, it would preserve such beasts as went over it, the same not being infected from taking it, and being put thryse about the neck of the beast infected, it would cure it, these words being rehearsed:

[44] *Transactions Gaelic Society of Inverness*, 1901-2, *25*: 129.
[45] *Ibid.*, 1904-7, *26*: 286-7. [46] Dalyell, *op. cit.*, p. 252.

In the name of the father, son and holy ghost
Let never this work be wrought in waist.[47]

A small flattish oval pebble of multi-coloured quartz, measuring 2½ inches in length by 1½ inches in breadth, was used as a prophylactic amulet by a farmer in Forfarshire who died, in 1854, at the age of eighty four. The stone was kept in a small bag hung round his neck by a red string. Both bag and string have now disappeared but the stone remains.[48]

The " Clach Spotaiche," or spotted stone, and the " Clach Ruaidhe," or red stone, two stones of coarse dark basalt, enjoyed a certain amount of fame as animal cures, at least in the north of Scotland. The first was used " over the whole district for rubbing horses suffering from stoppage of the urine," and the other " for rubbing the udders of cows when hardened and inflamed by disease." Both were being used as late as the end of the nineteenth century.[49]

A small perforated ball of Scotch pebble $1\frac{1}{16}$th of an inch in diameter, which was in the possession of a family named Duncan of Rosehearty for at least six generations, has the virtue of curing diseases of the eye. Known as an " ee-stehn," it was thought to contain all the colours of the eye. When it is put into a mixture of milk and water, a lotion is formed capable of curing every kind of disease of the eye. And as is the case with so many of these charm cures, the stone immediately looses its potency if it touches the ground.[50]

The perforated greenstone pebble shown in Fig. 1(a) was used in Cumbernauld, Scotland, to protect cattle from disease, and similarly a green sandstone pebble, Fig. 1(b), with two holes and the name William H. Scott inscribed on one side, was hung up in a byre in Dumfries. Dark red heart-shaped stones, mottled serpentine and jasper pebbles, were employed in the Shetland Isles to cure ailing cattle and recover milk to cows, Fig. 1 (e) and (c).[51] For a similar reason holed stones were suspended over byre doors so late as 1896 in Ballymena (Ireland),[52] and the yellow flint stone, Fig. 1 (d), at a byre in Slains (Scotland.[53]

From South Uist, a cure for the " Ruaidhe "—a rash causing swelling

[47] McPherson, *op. cit.*, pp. 261-2.
[48] R. B. K. Stevenson: List of Charms in National Museum of Antiquities of Scotland, prepared for the International Conference on Celtic Folklore, 1953.
[49] *Proceedings Society of Antiquaries of Scotland*, 1892-3, *27*: 450-1.
[50] Gregor, *op. cit.*, p. 39.
[51] Stevenson, *op. cit.*
[52] Pitt Rivers Museum, Oxford. Private communication.
[53] Stevenson, *op. cit.*

of the udder and retention of the milk with consequent pains—was to rub the swollen teat with a stone from a march burn, reciting at the same time over the animal.

> O Christ, heal the cow
> Heal thou it, O Mary—
> Thou broughts't for the Son
> May the udder be healed;
> May the swelling cease;
> And thou great swollen dry Rash
> Leave this place, and be off.

In a variant of the same charm, a burning peat was held under the udder, the teats were squeezed in succession, and the milk allowed to drop on the peat until it was partially extinguished. The smoke was considered medicinal. As the cow was being milked the above incantation was recited.[54]

Fire and smoke were everywhere considered medicinal and particularly if the fire was in any way associated with one of the Christian saints. Wild wormwood twigs known as " Muggurth twigs " were used in the south of Ireland in 1897 as a preventative against disease, after being singed in St. John's fire.[55] Fires were made on Mid-summer Eve and Hallowe-Eve when animals were made to pass through the smoke to rid them of disease. In the event of violent outbreaks in any district, a special fire known as " needfire " was raised by the concerted action of all the farmers in the district. After various ceremonies were enacted and ritual conditions satisfied, the smoke was made to blow over the animals or they were driven, usually three times, over the embers of the fire. The last recorded case was at Dallas (Scotland) in 1850, when an outbreak of murrain swept through the district.[56]

Reference to the use of smoke is made, in the Anglo-Saxon collection of leeches entitled " Lacnunga," in a cure for lung trouble in cattle. Take

> the plant found in homesteads, it is like the plant " hound's stale "; there grows black berries of the same size as other peas. Pound; put into holy water; put into the mouth of cattle. Take that same plant, put upon burning coals, and fennel and hassock and fine lined and incense. Burn all together on the windward side; make it smoke upon the cattle.[57]

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[54] A. Mackenzie: *Gaelic Incantations, Charms and Blessings of the Hebrides*, 1895, pp. 54-5.

[55] D. McKenzie: *The Infancy of Medicine*. London: Macmillan, 1927, p. 164.

[56] G. Cumming: *In the Hebrides*. 1883, p. 194. See also *Antiquity*, 1955, *115*: 132-6.

[57] Grattan and Singer, *op. cit.*, p. 178.

Symptoms in horses of abnormal sweating and general exhaustion were known in the highlands of Scotland as " na mareaich "—" the riders." This name derives from the once widespread belief, particularly among the Teutonic races, that " Mara," a supernatural hag, took horses out of the stable at midnight and rode them to the point of exhaustion. The only safeguard lay in the use of enchanted stones suspended in the stable or over the lintel of the stable door. These were usually naturally perforated pebbles or flints, known in England as " hag-stones " and as " Mare-stones " in Scotland, Fig. 2(a).

Pennant, while in Dumfries, met a farmer of Pentonlins, who considered a naturally holed pebble an infallible cure, if hung over a horse that was troubled with nocturnal sweats.[58] The same custom was followed in Nithsdale in 1766,[59] and about 1686 Aubrey in his *Miscellanies* records " that in the west of Scotland (and I believe almost everywhere in this nation) the carters, and groomes, and hostlers doe hang a flint (that has a hole in it) over horses that are hagge-ridden for a preservate against it." [60]

We find the belief embodied in the following " charm for stables ":

> Hang up Hooks and Sheers, to seare
> Hence the Hag that rides the mare
> Till they be all over wet,
> With the Mire, and the sweat
> This observ'd, the Mains shall be
> Of your Horses all knott free.[61]

A Mare-stone exhibited at a meeting of the Anthropological Institute at Glasgow in 1877 belonged to a farmer near Edinburgh who hung it up in his byre behind any cows expected to calve.[62]

Edward Llwyd, keeper of the Ashmolean Museum, Oxford, writing in 1699 from Linlithgow in Scotland, says that in the Highlands

> they have the *Ombriae pellucidae*, which are crystal balls or depressed ovals, which were held in great esteem for curing of cattle; and some on May Day put them into a Tub of Water, and besprinkled all their cattle with the water to prevent being Elf-struck, bewitched, etc.[63]

A ball of rock crystal, at one time in the possession of the Marquess of

[58] T. Pennant: *Tour in Scotland, 1769*, vol. 2, p. 86.
[59] *Scots Magazine*, 1766, *28*: 229.
[60] J. Aubrey: *Remains of Gentilisme and Judaisme*. 1881, p. 28.
[61] J. Brand: *Observations on Popular Antiquities*. London: Knight, 1841-2, vol. 2, p. 586.
[62] *Proceedings Society of Antiquaries of Scotland*, 1892-3, *27*: 523.
[63] *Philosophical Transactions of the Royal Society of London*, 1713, *28*: 99.

Waterford, Ireland, and which, according to family tradition, was brought from the Holy Land by one of his Le Poer ancestors at the time of the Crusades, was eagerly sought after by farmers. The stone was placed in a running stream through which the diseased cattle were driven backwards and forwards, or it was placed in the water given them to drink. Another, " of shining crystal about the size of a large marble," was dipped into water once a year and the water given to farmers for their cattle.[64]

An interesting example of a cure employing a rock crystal pebble in water was practised in Perthshire. The pebble was used to protect cattle from all kinds of diseases and when not in use was kept on the lintel of the byre door at a croft near St. Fillans. The crystal, however, was only one of the active elements; in addition, the animal had to be given, as a drench, " dead-water " brought in silence. Two or three pieces of silver money were added to the water " in the name of the Father, of the Son and of the Holy Ghost." [65] There are two interesting details in the above account: " dead-water " and the injunction on silence.

With regard to the " dead-water," the belief in its medicinal virtues persisted up to the beginning of the present century. William McPherson of Boganore was advised to give his ailing stock a drench of it, but it had to be collected in a " three girdit cog " in the evening, and in complete silence, from a stream over which the living and dead cross.[66]

The use of dead water which appears in association with a wide variety of charm cures was regulated by many diverse conditions which differed throughout the country.

Three conditions, however, appear to be common. In the first instance, it must be taken from a stream over which the living and dead pass, that is, a stream running in front of the entrance to a burial ground, from a south-running stream, or from a fairy well. In the second instance, the water must be brought unspoken. The bearer must keep silence, and not infrequently there was the further condition that none must speak to him or her. To ensure that this condition was satisfied, there is evidence to show that on occasions the bearer took a companion with him. Thirdly, any surplus water must be got rid of in such a way that no animal could be infected by coming in contact with it. Usually it was returned to the stream from which it was taken, or to any fast running stream, so that its powers would quickly be dispersed.

[64] *Proceedings Society of Antiquaries of Scotland*, 1892-3, *27*: 523.
[65] *Ibid.*, p. 454.
[66] *Aberdeen Journal: Notes and Queries*, 1910, *3*: 191.

Special magical significance was attached to the insistence on silence during the curative rites and in the gathering of herbs and other ingredients. In Anglo-Saxon texts silence is enjoined in gathering herbs for curing ' elf-disease ' in cattle.

> On Thursday after sunset where helenium stands and stick thy knife into the plant. When day and night divide go to church and cross thyself; then go (to the plant) in silence and though aught terrifying meet thee, say never a word till thou reach the plant. Delve it up and lay it under the altar till the sun be up!

An ' elf-shot ' horse according to the same MSS must be pricked in silence.[67]

In most cases the charm cure was rendered abortive should silence be broken. This happened, for example, at a farm near Bury St. Edmunds, Suffolk, where two pigs were suffering from a form of madness thought to be due to witchcraft. The remedy in this case was to cut off their tails and collect the blood in a pot which was then put on to boil. All this had to be done in complete silence. The idea was that as the blood boiled, the witch responsible would be drawn towards the farm and forced to remove the spell. Unfortunately the farmer made some remark, with the result that the pigs died, and the witch remained undetected.[68]

5.

The material in this group affords the greatest variation in type, combination, and usage. By association, manufactured objects of almost every description were thought to have magical powers. Prehistoric artifacts, such as neolithic and bronze age arrow-heads, axes, and celts, were believed, because of ignorance respecting their true origin, to be missiles of the gods and thus endowed with supernatural properties. Inscribed charms on paper, ornamental brooches and pendants, coins, wood, and stones were all used singly and in various combinations.

A common name in the highlands of Scotland for a rock crystal ball, ovate sphere, or pebble mounted for suspension as an amulet, was " Leug," " Loug," or " Leigheagan," and in a contemporary MS it is defined as " a great piece of the clearest cristall, in forme ane halfe ovall, near to the bigness of a littel hen eage: but I find it being of great use for peple that has cows, being good for many diseases. They sik great monies for it, as forty pounds Scots.[69] Shaw in his *Gaelic Dictionary* was probably

[67] Cockayne, *op. cit.*, vol. 3, p. 346.
[68] *Folk-Lore*, 1926, *37*: 77-8.
[69] Dalyell, *op. cit.*, p. 679.

referring to such a ball when he says " priests keep it to work charms by and water poured upon it at this day (1780) is given to cattle against disease."

A ball of rock crystal, or ' crystal gem ' as it was known, about 5½ inches in diameter and mounted in silver, was long in the possession of the Campbells of Glenlyon. It was known as the " Clach Bhuai," or powerful stone, and appears to have been used in the cure of animal diseases, people coming above 100 miles for water in which it was dipped. The water had to be carried to the amulet by the people wanting the cure, and to make more certain that the water was sufficiently medicinal and effective, the stone, during the process, had to be held in the hand of the laird.[70]

A similar but slightly smaller amulet the " Clach Dearg," or Stone of Ardvoirlich, is a ball of rock crystal mounted in a setting of four silver bands, with a ring at the top for suspension. The belief in its virtues as a cure for diseased cattle continued well into the latter half of the nineteenth century, and as in the case of the " Clach Bhuai," farmers came from widely different parts of the countryside to get supplies of water in which the amulet had been dipped.

Various conditions, however, had to be observed by those who wished to benefit by its healing powers. The person who came for it had to draw the water himself and bring it into the house of Ardvoirlich in a vessel into which the stone was to be dipped. A bottle was then filled and carried away, but during its transport home it must not touch the ground nor be taken into any house by the way, otherwise its magical virtues would disappear. If a visit had to be paid, then the bottle was carefully left outside.[71]

The " Clach-na-Brataich," or stone of the standard, an unmounted ball of rock crystal 1¾ inches in diameter, has been in the possession of the Clan Donnachaidh since the year 1315. A manuscript, written about 1777, states that

> it is still looked upon in the Highlands as very Precious on account of the Virtues they ascribe to it, for the cure of diseases in Man and Beasts, Particularly for stopping the progress of an unaccountable mortality amongst cattle. People came frequently from places at a great distance to get water in which it had dipt for various purposes.

The last occasion on which it was used appears to have been sometime between 1823 and 1830, when it was dipped with great ceremony by the

[70] Pennant, *op. cit.*, 1769, vol. 1, p. 116.
[71] *Proceedings Society of Antiquaries of Scotland*, 1861, *4*: 220-1.

chief of the clan in a large china bowl filled with water from a "fairy well," after which the water was distributed to a number of people who had come great distances to obtain it for medicinal purposes.[72]

The Keppoch Amulet, found, according to legend, growing out of the top of a toad's head, is

an oval of rock crystal, about the size of a small egg, fixed in a bird's claw of silver, with a silver chain attached by which it was suspended when about to be dipped in water. While the stone was being dipped a Gaelic incantation, given here in English was pronounced invoking the Apostles, the Virgin, the Trinity and the Angels:

> Let me dip thee in the water,
> Thou yellow beautiful gem of Power!
> The water of purest ware,
> Which (Saint) Bridget didn't permit to be contaminated.
> In the name of the Apostles twelve,
> In the name of Mary, Virgin of virtues,
> And in the name of the High Trinity
> And all the shining angels,
> A blessing on the water, and
> A healing of bodily ailments to each suffering creature.[73]

The reference here to the Celtic Bride or Bridget derives from the well "Tobar Bhride" (Bridgets' Well) near Keppoch, from which the water into which the amulet was dipped had to be taken. St. Bridget was one of seven saints specially invoked for the protection of sheep and cattle, and she is often depicted in Christian art holding a cow, standing by a barn, or with milk pails; one of her titles was "Christ's milkmaid."

The final example of a rock crystal charm stone is the ancient Celtic brooch belonging to the Campbells of Ballochyle, Argyll, and dated approximately to the latter part of the sixteenth century. It consists of a silver gilt setting 5½ inches in diameter, with a rock crystal in the centre. An inscription cut in Roman characters round the outside rim of the setting reads: DE– SERVE AND HAIF / THE – HEVIN – BABAIF. Even to a late period it was used as a protective amulet against, and as a charm cure for, diseases in animals. It was simply dipped into water or whatever potion was prepared for the sick animals.[74]

In the following example, which is recorded for Perthshire in 1826, four pebbles and five old coins were dipped in "dead water" brought in a "three girdit luggie" from the stream adjoining "two lairds' lands,"

[72] *Ibid.*, 1861, *4*: 219, 220; 1887, *21*: 226-36.
[73] *Ibid.*, 1892-3, *27*: 442.
[74] *Ibid.*, 1853-4, *1*: 170.

The stones and coins were dropped into the water and stirred by hand three times. The water was then bottled and given as a drench.[75]

The type of coins used in the above example is not recorded, but it is reasonable to assume that they were made of silver. Silver has always had the reputation of being a potent charm against witchcraft and the evil eye. For example, a silver sixpence of George III, called a 'crossie-croon' shilling by the country people, was used as a protective charm by a farmer's wife in Pitsligo. It was placed in the milking pail when a cow was milked for the first time after calving, for the purpose of preventing witches from affecting the cow's milk.[76]

At Lockerby, Dumfriesshire, a piece of silver called the "Lockerby Penny" was considered a sovereign cure for cattle madness. It was put into a cleft stick and used to stir water in a well, after which some of the well water was bottled and given to the animals affected. The "Penny" was lent to farmers on a deposit of 50 pounds, and during the late eighteenth century bottles labelled "Lockerby Water" were to be found in many farms and crofts. "A few years ago (ca. 1880) on a Northumbrian farm, a dog bit an ass, and the ass bit a cow, the penny was sent for the dog was shot, the cuddy died, but the cow was saved through the miraculous virtue of the charm." [77]

The Lee Penny or Lee Stone was probably the most widely known and celebrated lithic amulet used in the cure of animals, particularly infected cattle. The amulet, Fig. 3, consists of a heart-shaped deep red pebble of carnelian-agate set in an Edward IV silver groat.[78] In an *Account of the Penny in Lee*, dated 1702, it is stated that the amulet, "being taken and put in the end of a cloven stick, and washen in a tub of water, and given to cattell to drink, infallably cures almost all manner of diseases." [79] During the Reformation when amulets of every sort were under suspicion as savouring of witchcraft, the alleged virtues of the Lee Penny formed the subject of a complaint laid against its owner, Sir James Lockhart, "anent the superstitions using of a stone, set in silver, for the curing of diseased cattle." But its power over cattle disease was so universally believed in and resorted to as an ordinary practice by "husbandmen of the best sort," it became exempted from the anathema which the Scottish clergy were denouncing against other superstitious practices.

[75] *Folk-Lore*, 1945, *66*: 274.
[76] Stevenson, *op. cit.*
[77] W. Henderson, *op. cit.*, p. 163.
[78] *Journal British Archaeological Association*, 1865, *21*: 325-6.
[79] Dalyell, *op. cit.*, p. 680.

During the reign of Charles I it achieved a spectacular triumph. It was loaned to the corporation of Newcastle, on a surety of 6,000 pounds, to cure a cattle plague which was then sweeping through the area. The stone was taken south, the plague abated, and the corporation offered to buy the stone. The offer, however, was rejected.

Mr. Hector Maclean, factor to the Lee estates, writing in 1853, records an interesting cure which had taken place some months previously. In Kirkwhelpington during an outbreak of rabies among the sheep and cattle, a horse believed to be mad bit a man in the hand. An urgent request was sent for water in which the Lee stone had been dipped. A small barrelful was immediately dispatched, and the man was at once treated with it, and made an excellent recovery.[80]

From the many references to its use, iron appears to have possessed supernatural virtues of equal potency to silver. The reason derives probably from very ancient times when iron was a rarity and from the observation of iron (meteoric) falling from the sky. References to the taboo and magic potency inherent in iron can be found in the Bible, in Egyptian, Mespotamian, Greek, and Roman magic, in Anglo-Saxon texts, and up to very recent times in the folk lore of Europe; isolated cases may still be found in Britain.

When black cattle were first housed, it was customary in various districts of Scotland to lay the plough sock or any other piece of iron in the doorway and make the cattle walk over it. This, it was believed, ensured freedom from disease throughout the coming year.[81] In the event of a cow's milk supply drying up, the Lancashire farmer plunged a red hot iron into the churn;[82] in Leinster, Ireland, for the same reason plough-irons were thrust into a fire and connected with the churn by twigs of rowantree.[83] A variant is seen in the use of ironstone amulets in Cambridge,[84] Fig. 2(b).

Plough irons were also an integral part of a charm cure practised by Alexander Drummond of Auchterarder (Scotland) in 1630. He was accused of "burning a quick ox for effectuating his sorcerie, and of pleuch-irons upon merches betwixt two laird's lands," for curing madness.[85] From Fountains Abbey (England) is recorded the use of St.

[80] *Proceedings Society of Antiquaries of Scotland*, 1892-3, *27*: 496-7.
[81] Ramsay, *op. cit.*, p. 456.
[82] W. Henderson, *op. cit.*, p. 183.
[83] *Ibid.*, p. 184.
[84] University Museum of Archaeology and Ethnology, Cambridge. Private communication.
[85] L. Spence: *Myth and Ritual in Dance, Game, and Rhyme*. London: Watts, 1947, p. 158.

Wilfred's burning or branding iron for the cure of murrain. In 1535, for example, the proceeds from the use of this burning iron were £1. 6.8. The origin of this branding iron is unknown. In all probability it was used for branding cattle, after its original use as the ancient *ferum judiciale* for the purposes of ordeal was no longer required. Similarly there was used in France a chapel key for branding horses suffering from pest (1728), and keys of churches were applied hot and cold to the heads of dogs to cure madness (1777). Godoz, writing in 1887, also gives information about the keys of Saint Hubert, Saint Peter, and other saints, used as branding irons.

The keys of Saint Hubert, which bore the device of a horn, were blessed and made to touch the stole of the saint. They were applied red-hot to the infected part of the animal, one of the family reciting five Peters and an Ave daily for nine days in honour of God and Saint Hubert, while bread or oats blessed by a priest were given to the animal each day before other food.

The " irons " might not be used to brand men and only for the animal for which they were blessed.[86]

Returning to Llwyd's reference to the Highland *Ombriae pellucidae*, mention is made of the virtue of crystal as a protection for elf-struck cattle. " Elf-struck " or " elf-shot " was anciently thought to refer to the wounding or the disease inflicted on animals shot at or struck down by an elf-arrow.[87] These elf-arrows or fairy-darts, in reality neolithic flint arrow-heads, were constantly being turned up in the soil, and to account for the similarity in their shape and size it was thought that they were thunderbolts or missiles of the gods, and as such they were believed to to possess magical powers. This belief was, in fact, extended to include practically all prehistoric artefacts.

Neolithic celts and bronze axes were used quite indiscriminately as curative and prophylactic amulets. A specimen of neolithic celt was in use as late as 1899 at Ballymena, Ireland. It was boiled in water, and the water was given to cows suffering from " grup." [88] An Iron Age bead of dark blue vitreous paste ornamented with inlaid spirals of yellow enamel, known locally as a serpent stone, was for many generations in possession of a family in Skye. It was borrowed regularly because of its supposed

[86] Memorials of Ripon, 3: 167 corrigenda 31. Surtees Society, 81, Fabric Rolls, No. 6 (1503-4).

[87] T. D. Davidson: " The cure of elf-disease in animals." *J. Hist. Med. and Allied Sc.*, to be published, July, 1960.

[88] Pitt Rivers Museum, Oxford. Private communication.

efficacy in the treatment of diseased cattle and dipped into their drinking water.[89]

By a simple extension of the contemporary belief in sympathetic magic that "like affects like," the elf-arrow which was thought to have caused the disease, could also cure it. Hence they were among the most highly prized amulets. This belief was further extended to include the cure of almost any infliction which defied regular diagnosis. The *modus operandi* was fairly straightforward: the inflicted animal was rubbed down with the arrow head, or the animal was made to drink water in which the arrow head was dipped. Many variants on this simple cure were introduced. The variations are due more to the ingenuity of the particular cow-doctor concerned than to any established ritual practice. They consisted mainly in a lengthening of the rite by the inclusion of other ingredients and conditions to be satisfied. Examples from England and Ireland illustrate this point. "Elf-shotten" animals in Northumberland were cured simply by touching the animal with the arrow head and giving it some water to drink in which the arrow had been dipped.[90] In Ireland, a silverpiece known as "the thirteen pence piece" with a cross on it, several flint arrow heads, and three bad halfpence are required. The cow-doctor then takes the juice of the herb *Achemilla vulgaris* or Lady's Mantle and places it in a pail of water which has been scooped up against the flow of the stream where three townlands meet. The coins and one flint are added to the mixture, and the cow is given three sups; some of it is poured down her spine and massaged in with some dirt from her fore-feet. The remainder of the mixture is poured into her ears.[91]

In the islands off the west coast of Scotland, various drift seeds have been held in high repute as amulets against disease in cattle. The fact that they were sea-borne and of comparative rarity was the main contributing factor for the belief. The commonest specimens found are *Dolichos vulgaris Guilandina Bordue, Entada gigantea* and *Ipomeoc tuberosa* which are carried across the Atlantic Ocean by the Gulf Stream. A typical specimen, used as an amulet in Barra until the late eighteenth century, is shown in Fig. 2(c).

In the Hebrides, the local name was "Saint Maries Nutt" or *Airne Moire*—(Virgin) Mary's Kidney.[92] Martin mentions several of the virtues and points out that they are of various colours, but the most highly

[89] *Proceedings Society of Antiquaries of Scotland*, 1863, *5*: 313.
[90] *Folk-Lore*, 1889, *23*: 45.
[91] *Ibid.*, 1883, *17*: 200.
[92] *Transactions Gaelic Society of Inverness*, 1891-2, *18*: 116-23.

valued have a cross indented on the sides. He records the following instance of their use, The cows belonging to a farmer on the isle of Harris gave blood instead of milk. To effect a cure, he was directed to take

> a white cut call'd the Virgin Mary's Nut, lay it in the pail into which he was to milk the cows . . . . having milk'd one cow into the Pale with the Nut in it, the Milk was all Blood, and the Nut chang'd its colour into dark brown: he used the Nut again, and all the Cows gave pure good Milk, which they ascribe to the Virtue of the Nut.[93]

One of the commonest and most widely used amulets was rowantree (mountain ash) in the form of twigs looped together, or bound with red thread or wool into the form of crosses. Its use as a prophlyactic against blight from the evil eye, cattle plague, and elf disease, as well as for protection for milking cows, was common practice throughout the British Isles. Animals were made to pass through large loops, cows when first milked after calving were milked through loops, and sprigs and crosses were tied to the horns, tails, and manes of all the farm animals.

In 1644, a Culross (Scotland) crofter tied a piece of rantle-tree (rowantree) under the tail of his cow and repeated thrice on his knees, " Lord Jesus, send me milk." The ailment, unspecified, was cured, for the cow gave milk in abundance.[94] During the cattle plague of 1866 at Marshlands (England), every cowshed, it was reported, had a rowan cross suspended over the door.[95]

Not infrequently we find, as for the case of plants and special water, that various conditions had to be observed properly to carry out the cure. Silence was observed during the cutting and gathering, and both time and place must be auspicious. In Cleveland (England), for instance, wicken (rowantree) twigs must be gathered on May 2nd, known locally as " Rowan-tree Witch-day," and conveyed secretly back to the farm.[96] In Yorkshire, the issue was further complicated by the use of " heder-wicken " and " sheder-wicken." " Heder " and " sheder," terms usually applied to lambs, are used here simply to express male and female, the idea being that the " heder " variety was used for ailments attributed to the influence of male witches, and the " sheder " for those attributed to female witches.[97]

An interesting protective amulet, found only in Yorkshire, was known

[93] M. Martin: *Description of the Western Isles of Scotland*, 1716, pp. 38-9.
[94] *County Folk-Lore*, 1912, *7*: 109-10.
[95] R. M. Heanley: " The Vikings: Traces of their folklore in marshland." *Saga Book*, vol. 3, pt. 1. London: The Viking Club, 1902, p. 50.
[96] *County Folk-Lore*, 1901, *2*: 59 [97] *Ibid.*, 1908, *5*: 26.

as a "witch-post." This post, always made of rowan wood and marked by an inscribed cross, formed part of the structure of a house, usually under a cross-beam of the timber framework. A crooked sixpence was kept in a hole in the centre of the post, and a knitting needle was kept in a groove at the top.

When cows had been deprived of the substance of their milk (a blight commonly attributed to witchcraft) so that it would not churn into butter, the sixpence was carefully lifted out of the hole with the knitting needle and placed in the churn. This combination of silver and iron in association with rowan wood counteracted the witchcraft and removed the blight.[98]

The Pitt Rivers Museum example shown in Fig. 4 is described as follows: Post belonging to a seat on the hearth of an old house in Scarborough (England). Carved with representations of a cross, heart stuck full with pins and different phases of the moon.[99]

Nowhere is the belief in the supposed influence of nature spirits better evidenced than in the widely distributed prophylactic use of harvest amulets. The fertility or corn spirit was thought to reside in the last sheaf of corn left standing in the field. This sheaf was ceremoniously cut and fashioned into small figures called by such regional names as "kirn-dolly," "mare," and "neck" in England, and in Scotland as "corn-maiden," cailleach" (old woman), "clyack," and in Wales and Ireland as "gwrach' and "hare" respectively. They were taken back to the farm and kept until Hallow-Eve (October 31st) or New Year's morning when they were distributed among the cattle, horses, mares in foal, and calves, in the belief that the fertility spirit would be passed on and so preserve them from sickness and disease throughout the remainder of the year.

The speciment shown in Fig. 5 is a clyack sheaf made, in 1893, from the last sheaf of oats, cut and ornamented with a piece of wallpaper and ribbons. It was found hanging in a farmhouse at Glenairn (Scotland).[100] A particularly interesting variant, made from chestnut wood, took the place of the corn dolly in the village of Tirley (England).[101] Here, of course, the figure was kept safely in the byre from one harvest to the next, and the fertility influence was thus retained from year to year.

Lengths of wool, thread, and yarn in various compositions, combinations, and colours possessed more or less the same magical virtues.

[98] *Yorkshire Archaeological Journal*, 1956, *153*: 144-5.
[99] Pitt Rivers Museum, Oxford. Private communication.
[100] *Ibid.*
[101] *Folk Museum Gloucester, Guide to Bygone Agricultural Implements*, 1950, p. 13.

Known as " wresting threads," " spraining strings " and, in Ireland, as " worm-knots," they were made up from single threads and multiple-ply yarns of various lengths. Red was the predominant colour, but often a thread the same colour as the animal to be treated was chosen. Where the treatment was for sprains and bone fractures, knots, either three, seven, or nine, were tied in the middle and ends. There was a marked uniformity in the way in which the thread was applied. It was tied to, tied round, or laid on the animal while the operator intoned a prayer or rhymed incantation. The thread was then removed, knotted, and destroyed. The accompanying chant was basically of the following pattern, but different operators in different districts introduced their own variants:

> Bone to bone
> Synnew to synnew
> and flesche to flesche
> and bluid to bluid
> it wold mak ony wrest of beast haill.

During the entire operation the thread must not be allowed to touch the ground, and the knots must be cast on the thread in complete silence.[102]

An interesting detail in some examples from the west highland region of Scotland is that, in carrying out the knot casting and tying on, the thumb and forefinger must not be used. The traditional reason given is that with them Eve plucked the fruit, and so they are not blessed.

The rationale of such belief and customs in fairly simple. They depend upon the notion of sympathetic magic in its lowest stages of conception, namely similarity and imitation, carried through into the more sophisticated animistic stage of belief. To the primitive mind the reality of spirits seemed so clear that all natural phenomena were interpreted in terms related to the motives of these spirits. The use of magic and semi-religious ritual may therefore be regarded as a primitive experiment technique designed to control these spirits by sympathetic magic and placate or propitiate them.

The fundamental rule of all magical reasoning is that casual connection in thought is analogous to causative connection in fact. Like suggests like to the primitive mind by the mere association of ideas, so that like influencing like produces analogous effects in practice. This is not remarkable, for exact coincidence would be very powerful in producing and stimulating belief in the association of events and their repetition. By a

[102] *New Statistical Account of Scotland: Shetland (1841-3)*, p. 141. Private communication, A. A. Macgregor.

further extension of this reasoning, the part suggests the whole, thus giving rise to the primary ideas of a sympathy or identity existing between an original, or any part, and its image substitute.

Sickness and disease could be cured by transferring it from the afflicted beast to an inanimate, or animate, object by bringing the two into contact. Spraining strings, threads, and worm-knots were tied round, or laid on, the animal: the disease was transferred to the thread which was removed and destroyed. Burying or burning were the obvious and convenient means of destroying the wool, but any method which ensured rapid disintegration could be used, as, for example, casting it into running water. For bone fractures, knots were cast on the thread to simulate the knitting or tying together of the bone. Similarly, a limb, heart, or other part of a diseased animal was buried or burnt, so that the disease would waste away and eventually die out of the rest of the herd as the thread, limb, or heart, decayed and disintegrated. The supernatural virtues of stones and other amulets was conveyed by direct contact by tying the amulet to the beast or via the agency of the water in which they were immersed and which was then used for sprinkling the animal, or given as a drench.

The original rituals were probably simple imitative rites, pagan chants, and the use of amulets whose power lay in their shape, colour, and association. By mediaeval times cumulative tradition and the adoptive and sanctioning action of the Christian Church had imparted a certain air of authenticity to them. Invocation of Christ and the Saints was substituted for the invocation of spirits; hence we find in Anglo-Saxon MSS pagan and christianised-pagan remedies and recipes, saints' relics (St. Fillan's Crozier for finding lost cattle,[108] St. Wilfred's burning iron for murrain), and amulets in the form of the cross, being used side by side with equal credulity. During the next few centuries these rituals and recipes acquired a degree of sophistication, due mainly to the pseudo-scientific interpretation of natural and supernatural phenomena culminating in the Doctrine of Signatures which reached its climax in the late seventeenth century.

The charms and amulets with their associated ritual as we find them in the eighteenth and nineteenth centuries represent the detritus of the early magical beliefs. Their real significance had been forgotten, so that their continuance into the nineteenth century was traditionally sanctioned by usage fostered, firstly, by the credulity of people only too willing to accept any form of relief, no matter how absurd or superstitious; and,

[108] Stevenson, *op. cit.*

secondly, by the need for the local wiseman or " cow doctor " to maintain his position against the advancing front of rationalism and veterinary science. To do this he developed the charm cure in two ways: he used ingredients such as herbs and water which by wide experience and observation had been found medicinal, and he invested the cure with an aura of mystery by the use of meaningless chants and snatches of degenerate prayers, and by lengthening and increasing the number of presumed active elements and introducing conditions to be fulfilled so minute and exigent as to make the satisfying of them almost impossible.

As an example of such we may quote the use in the north of Scotland of the herb " moan " or " mothan " as a prophylactic amulet to be attached to milking cows. This herb, said to be either the thyme-leaved sandwort or bog-violet, was found only on the top of a cliff or mountain where no animal had fed or trod; it had to be collected on a Sunday. Three tufts were selected, one was called by the name of the Father, another by that of the Son, and the remaining tuft by the name of the Holy Ghost. The finder then plucked, never cut, the tufts and recited:

> I will pull the *Mōan*
> The herb blessed by the Domnach
> So long as I preserve the *Moan*
> There lives not on earth
> One who will take my cow's milk from me.

The three tufts were then wrapped in cloth, taken home, and attached to the cows.[104] Failure of a cure, therefore, could readily be attributed, not to any lack of skill or knowledge on the part of the " cow-doctor," but to the omission of some particular detail outside his direct control.

Not the least remarkable feature of these customs is their continued use into the twentieth century. In Wales, for example, the inscribed charm shown in Fig. 6 was used regularly as a prophylactic against loss of milk until 1916 by a " cow-doctor " at Llanidloes,[105] and spraining-strings are still being prescribed in the highlands of Scotland.

The reason for this survival to-day in the more remote and isolated parts of the countryside among people of a curious conservatism can only be attributed to the belief in the power of chance. The value or virtue of tying an amulet to a beast was questionable, but on the other hand it could do no harm.

[104] Mackenzie, *op. cit.*, p. 32.
[105] Pitt Rivers Museum, Oxford. Private communication.

FIG. 1. (a)—Greenstone pebble amulet (No. 21) from Cumbernauld, Scotland. (b)—Green sandstone amulet (No. 29) from Dumfries, Scotland. (c)—Mottled Serpentine pebble amulet (No. 92) from Shetland, Scotland. (d)—Yellow flint amulet (No. 90) from Slains Scotland. (e)—Dark red heart-shaped amulet (No. 73) from Shetland, Scotland.

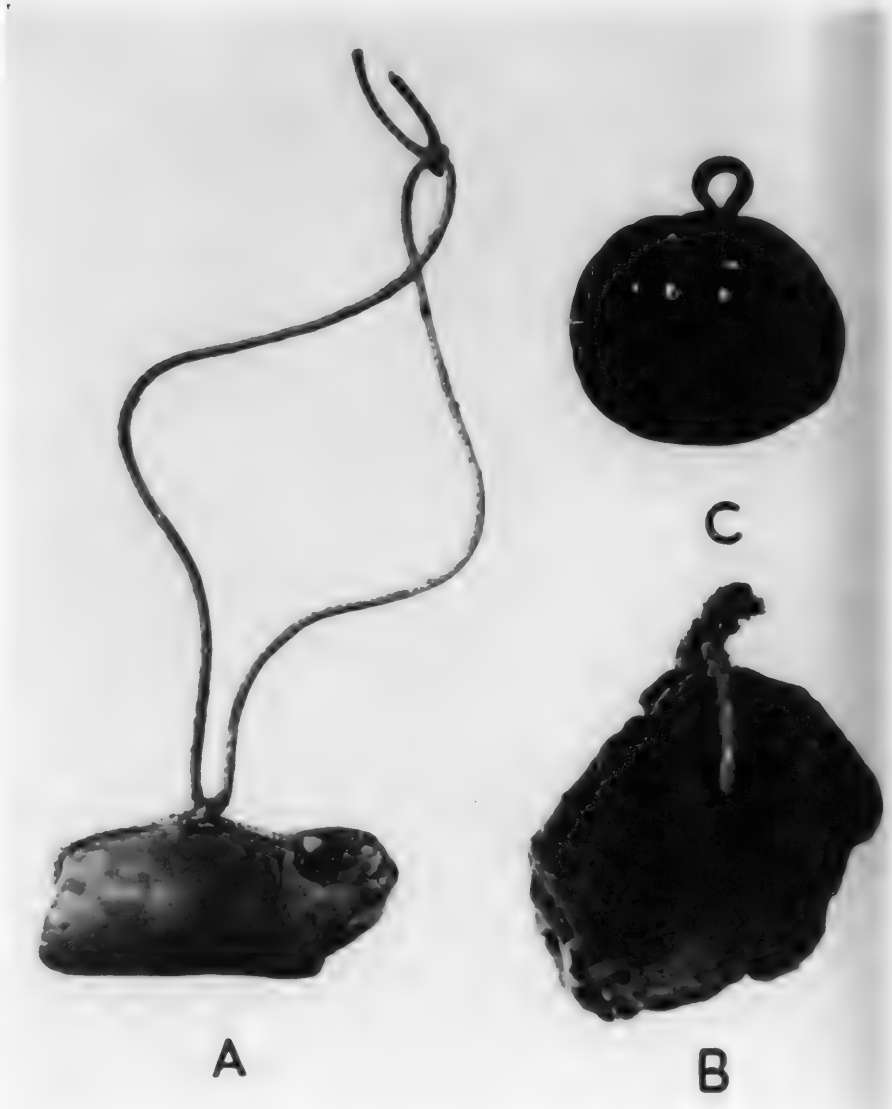
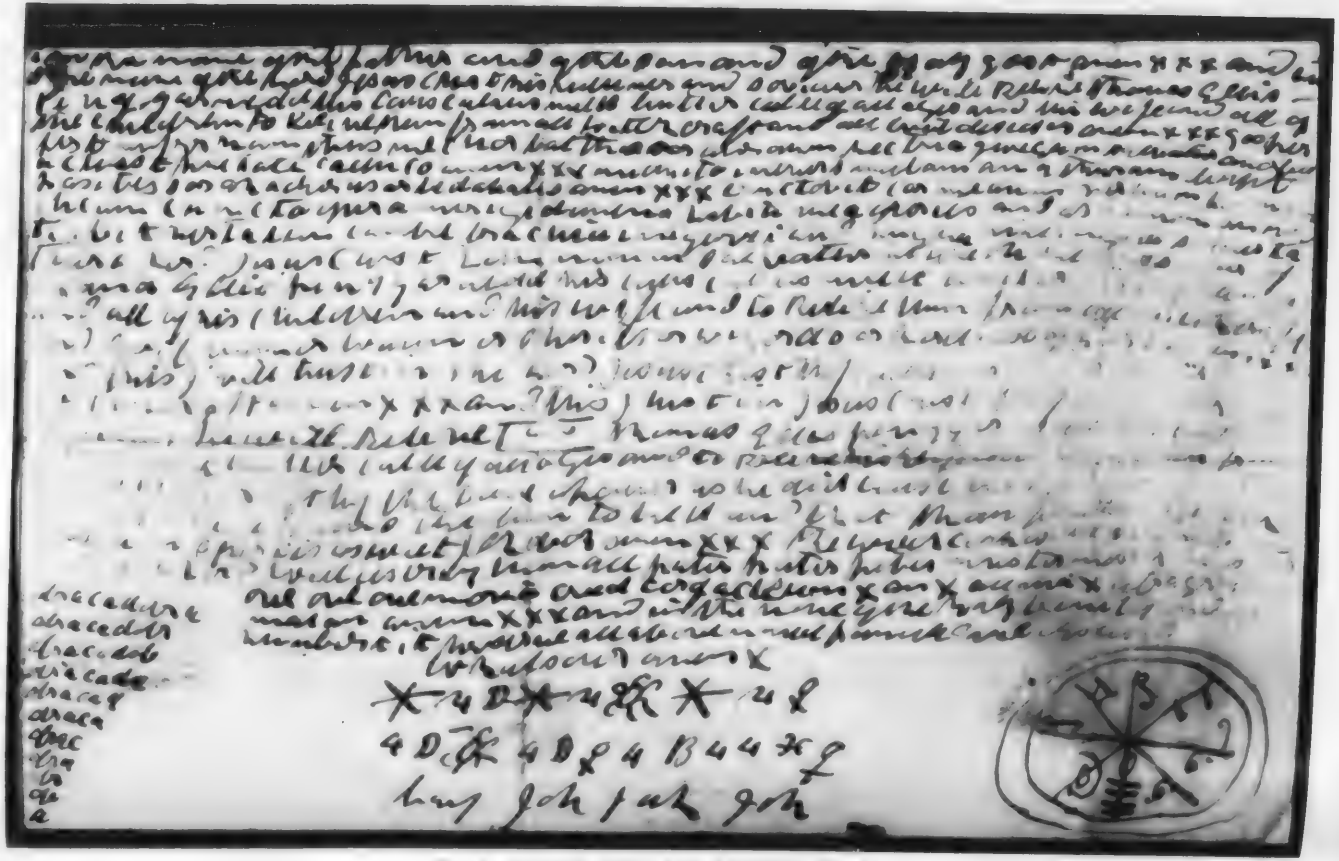


FIG. 2. (a)—Hag-stone amulet from Shelford, England. (b)—Holed ironstone amulet from Cambridge, England. (c)—Drift seed amulet mounted for suspension from Barra, Scotland.

Fig. 3. Lee Penny or Lee-stone amulet from Carnwath, Scotland.

FIG. 4. Witch-post amulet from Scarborough, England.

FIG. 5. Clyack sheaf amulet from Glengairn, Scotland.



THOMAS LINACRE, 1460-1524:

An English Physician Scholar of the Renaissance *

WILLIAM D. SHARPE

"Lofty designs must close in like effects:
Loftily lying,
Leave him—still loftier than the world suspects,
Living and dying."
—Robert Browning, 1855.

On October 20th, 1524, in the sixty-fourth year of his age, there died in the city of London from the complications of renal calculus a certain Thomas Linacre, Doctor of Medicine of the Universities of Padua and Oxford; founder and first president of the Royal College of Physicians of London; physician to Kings Henry VII and Henry VIII of England; priest of the Roman Catholic Church and one of the most erudite men of an erudite age. He was buried in old Saint Paul's Cathedral at a spot which he chose himself but, strange to say, no marker was erected to his memory until 1557, when John Keyes, his successor as president of the Royal College of Physicians and himself the founder of the scientific study of anatomy in England, erected a memorial brass at his own expense. This monument perished when the cathedral was destroyed during the great fire of London in 1666 but its text has been preserved and deserves quotation:

Thomas Linacre, physician to King Henry VIII; a man in Greek and Latin and in the art of medicine most learned of all: during his lifetime he restored to life many who were ill, some even who had despaired of life: with marvelous and unique eloquence he translated many works of Galen into the Latin language. At the request of his friends he published, a little while before his death, an outstanding work on the grammar of the Latin language. For students of medicine he endowed two public lectureships at Oxford and one at Cambridge. In this city, he organized the College of Physicians by his industry, and was elected its first president. Marvelously aloof from guile and deceit; faithful to his friends; distinguished in every class of society, a few years before he died he was ordained priest. Full of years he departed this life, much beloved, in the Year of Our Lord 1524, on the twentieth day of October. Virtue lives beyond funerary rites: John Caius has

* Read in abbreviated form before the Johns Hopkins Medical History Club, September 28, 1959.

THOMAS LINACRE (?)

Traditional portrait in the possession of the Royal College of Physicians.

erected this monument to Thomas Linacre, a most distinguished physician, in the year 1557.[1]

Like many scholars of his time, Linacre never married and for years lived a quiet life devoted to his classical studies and to what must have been a heavy practice as a consulting physician. He had few family or social ties, and although Linacre is well known for his accomplishments, as a historical person, since so little is known of his personality or private life, we cannot appreciate him as a warm human being in the sense, for example, that we know his friend Thomas More, and even the portrait traditionally assigned to his name is of uncertain attribution.[2] A man who had studied under Demetrius Chalcondyles, Nicolaus Leonicenus, and

[1] J. N. Johnson, *The Life of Thomas Linacre*, edited by Robert Graves (London, 1835), p. 346, quotes William Dugdale, *History of St. Paul's in London* (London, 1657), p. 56: "Epitaphium Thomae Linacri in Ecclesia Cathedrali Divi Pauli, Lond. juxta Boreale ostium, super laminam aeneam, muro affixam.

Thomas Lynacrus, Regis Henricis VIII. medicus; vir Graece et Latine, atque in re medica longe eruditissimus: Multos aetate sua languentes, et qui animam desponderant, vitae restituit: Multa Galeni opera in Latinam linguam, mira et singulari facundia vertit: Egregium opus de emendata structura Latini sermonis, amicorum rogatu, paulo ante mortem edidit. Medicinae studiosis Oxoniae publicas lectiones duas, Cantabrigiae unam, in perpetuum stabilivit. In hac urbe Collegium Medicorum fieri sua industria curavit, cujus et Praesidens electus est. Fraudes dolosque mire perosus; fidus amicis; omnibus ordinibus juxta clarus: aliquot annos antequam obieret Presbyter factus. Plenus annis ex hac vita migravit, multum desideratus, Anno Domini 1524, die 20 Octobris. Vivit post funera virtus. Thomae Linacro, clarissimo Medico, Johannes Caius posuit, anno 1557."

[2] The portrait, attributed sometimes to Holbein and said to be that of Linacre, is reproduced through the kindness of the Royal College of Physicians of London. The clerk at the College, Miss Ina Cook, in a personal communication to the present writer dated 16 October, 1958, refers to this and to the unpublished catalogue of portraits in the possession of the College prepared by David Piper, Assistant Keeper of the National Portrait Gallery, from which quotation is by permission: "Thomas Linacre, 1460?-1524. Panel, 19 by 14½ inches, copied by William Miller, 1810, from a painting at Windsor Castle.

Short half length to right, his right hand resting on a ledge and holding a folded paper inscribed *ANNO 1521*, his left hand close by; wearing a flat black cap, his hair cut just below the ears; face three quarters to right, pale grey eyes looking in the same direction; a slight shadowing of moustache on his upper lip; white shirt with small plain collar; dark gown trimmed at the edge with fur; dark brown background; lit from the left.

Copied at the order of the Fellows; a resolution to pay Mr. William Miller (the College Beadle and evidently an amateur painter of considerable competence) 20 guineas for the copy was passed 22 December 1810. Engraved by H. Cook in stipple. This is the usually accepted image of Linacre: the identity however has been challenged, and the original at Windsor is at present catalogued as *An Elderly Man* (School of Massys); it is in poor condition, and the date on the scroll is generally read as 1527 or 1537, though when Vertue saw it in 1734 it was evidently known as a portrait of Linacre,

Angelo Politian; who had enjoyed the patronage of Lorenzo Medici, Henry VII, and Henry VIII; who had perhaps eaten at the same table with Michelangelo Buonarroti, Marsilio Ficino, and Pico della Mirandola; whose only quarrel (and that over a book on Latin grammar) seems to have been with Dean Colet; and who had enjoyed the respect and friendship of Desiderius Erasmus, Bishop Latimer, Cardinal Wolsey, Pope Leo X, and Sir Thomas More would have been remarkable had he accomplished nothing beyond making so wide a circle of distinguished friends. Since his accomplishments, taken all in all, as a scholar, medical reformer, and translator would suffice to ensure the reputations of several men, a consideration of his life and works might not be without interest.

Early life and education

The exact date of Linacre's birth is unknown: most authorities agree that he was born in Canterbury about 1460 of a respectable Derbyshire family, but the names of his parents are unknown and we have no details concerning his childhood. A brother and sister, at least, survived him, but we know nothing of them. When about seven years old, he entered the lay school of Christ Church Monastery at Canterbury where he came under the influence of William Selling, an Augustinian monk and a fellow of All Souls College, Oxford, who was probably of gentle birth and possibly, but not very probably, distantly related to Linacre. Selling was enthusiastic over the new classical humanistic learning and took a great personal interest in the young Linacre. He had been educated at Oxford and had followed the ordinary scholastic studies of the day. He was later received as a monk in the monastery of Christ Church, then spent two years in Italy where he studied not only canon law but, while at Bologna, Greek with Politian. After his return to England, he became in time Prior of his monastery and headmaster of its school. His educational interests were unusual for that time in their emphasis on classical studies, that is, upon the careful study of the Latin and Greek languages. The word ***humanism*** must be used here rather strictly in its historical sense as referring to scholarly and, at first, antiquarian interest in classical

and he read the date as 1521, as did Miller in 1810. The earliest record of it however (in James II's catalogue) describes it as *An Old Man. a letter in his hand.* A somewhat similar portrait, but reversed, is at All Souls College, Oxford (presented between 1815-1840)."

William Macmichael (*The Gold-Headed Cane*, New York, 1926, pp. 81-85) mentions Linacre and this portrait which he evidently considered genuine at the time he wrote the book, first published in 1828.

culture accompanied by creative and critical writing in a consciously classical Latin style.

There had been earlier fits and starts toward a revival of learning in England [3] before the influence of the Italian Renaissance was felt, but during Linacre's formative years, the old scholastic tradition held the field. One cannot remain unimpressed by the intellectual achievement of the great schoolmen, culminating in the orderly survey of all things, human and divine, by Peter Abelard, John Duns Scotus, and Thomas Aquinas, but the logic which Aquinas has mustered to facilitate the consideration of the love of God or the nature of law had, over a few centuries, so overgrown its subject matter as to produce the scholasticism of the decadence, an empty verbalism as remote from religious as from secular thought which Thomas More considered as profitable as milking a billy-goat into a sieve. The ordinary young clerk of the time, intent on a university degree and a career in church or state, often had only a rudimentary education in humanities, skipping quickly over history and literature to rhetoric and dialectic. The result was all too frequently a shallow superficiality against which the best minds of the time—religious and impious—revolted, but things were beginning to change when, in 1480 at the then mature age of twenty, Thomas Linacre went to Oxfordtown.

Osler has summed up the academic situation at Oxford in those years as "studies scholastic, life monastic," [4] but this does not tell the whole story. At the time Linacre arrived in Oxford, the Italian scholar Cornelio Vitelli had begun public instruction as the first teacher of Greek in England since the early middle ages, and Linacre began work with him. There had been some interest in mathematics and medicine at Merton College, Oxford, since the fourteenth century,[5] but this was not very robust, and it cannot be said to have formed a scientific school in any sense of the word. Linacre's career at Oxford was a happy one: he was elected Fellow of All Souls in 1484,[6] at twenty-four, and he here became friends with Grocyn, Lily, and Latimer, the other members of that earliest group of Oxford humanists.[7]

[3] William Osler, *Thomas Linacre* (Cambridge, 1908), pp. 7-8; and C. E. Mallett, *A History of the University of Oxford* (New York, 1924), vol. I, pp. 343-344, comment on this.

[4] Osler, *op. cit.*, p. 5.

[5] Mallet, *op. cit.*, vol. I, p. 120.

[6] J. F. Payne, *Galeni Pergamensis de temperamentis . . . Thoma Linacro Anglo interprete . . . reproduced in exact facsimile with an introduction* (Cambridge, 1881), p. 7: "the supposition of any family tie between Linacre and Chichele or Selling must therefore be regarded as entirely baseless."

[7] William Grocyn was somewhat older than Linacre: he was born in Bristol or

Linacre in Europe

Sometime toward 1485, William Selling, Linacre's old headmaster, was sent on an embassy by King Henry VII to Pope Innocent VIII, and Linacre went along with him to Italy, then in the ascendance of its classical Renaissance. Although there had always been a few colonies of Greek speaking people in Italy, especially in the south in the region along the instep of the Italian boot called *magna Graecia*, they were far removed from the main currents of life. The revival of Greek studies in Italy was the work of scholarly refugees from the Eastern Empire who, as they fled after the capture of Constantinople by the Turks in 1453, brought with them to Italy not only their knowledge of Greek but often manuscripts of works unknown in Western Europe. How long Linacre remained in Italy, then the center of world commerce, letters, and science, is still unsettled: various estimates range from two to fourteen years, the evidence supporting a longer rather than a shorter sojourn.[8]

Wiltshire sometime between 1442 and 1446, the latter date being the more probable. Educated at Winchester College and at New College, Oxford, he was elected Fellow in 1467. After serving as tutor of William Warham, later Archbishop of Canterbury, in 1479 he accepted the cure of Newnton Longville, in Buckinghamshire, and on the income from this he lived at Oxford, devoting himself entirely to the study of Greek. Between 1481 and 1483 he was appointed Reader in Divinity at Magdalen College, an appointment which he interrupted from 1488 to 1491 for Greek studies in Italy with Chalcondyles and Politian. He returned to Oxford and resumed his lectures on Greek: apparently he had taught this even before his Italian travels. He seems always to have maintained his adherence to the medieval scholastic tradition. It was Grocyn who settled that the writings long attributed to Dionysius were not really by the Areopagite. After 1503 or 1504 he lived in London until his death in 1519: Linacre was executor of his will.

William Latimer (?1460-1545), who is not to be confused with Hugh Latimer, the Archbishop, was elected a Fellow of All Souls College, Oxford, in 1489: a quiet and retiring scholar, he served as tutor to the future Cardinal Reginald Pole and traveled in Italy with Grocyn and Linacre.

William Lily, Grocyn's godson, was born at Odiham in Hampshire. He traveled widely—Rhodes, Jerusalem, and Italy, where he studied with Pomponius Laetus. He took only minor orders and changed his mind about entering the priesthood, since he married and sired fifteen children before his wife and most of his family died during the epidemic of plague in 1517. He taught in London and joined with Linacre and More in writing light verse for their *Progymnasmata*. John Colet appointed him Master of Saint Paul's School in 1512, and he served until his death in 1522, following operation against Linacre's advice for what seems to have been an infected bony tumor of his thigh.

[8] P. S. Allen, "Linacre and Latimer in Italy," *English Historical Review*, 1903, *18*: 514-517, argues that Linacre was in Italy from his arrival there with Selling in 1485/1486 until 1499 and concludes that there is no evidence that he returned to England between Selling's mission to Pope Innocent VIII and Linacre's return to Oxford in 1499. Allen's reasoning is convincing: Linacre mastered Greek while in Italy, and this is not the work of a single day; the M. D. degree at Padua took at the very least three years to obtain,

After a time in Florence he went to Rome where, while working in the Vatican Library, he met the scholar Hermolaus Barbarus (1454-1494), son of a Venetian senator and grandson of a doge, who had translated into Latin and annotated the great Greek herbal of Dioscorides and who was at that time editing and translating into Latin the works of Aristotle. Next, Linacre left Rome for Venice, where he became a friend of, and perhaps lived with, the scholarly editor and printer Aldus Manutius Romanus (1449-1515), founder in 1500 of the "New Academy of Hellenists" which would undertake to publish some of the first critical editions of the classical Greek and Latin writers. It was probably during his stay in Venice that Linacre translated from the Greek into Latin Proclus' short mathematical treatise *On the sphere*. In the introduction Aldus pays high tribute to Linacre's scholarship, and, a few years earlier, he had mentioned him as a co-worker in the Aldine 1497 *editio princeps* of Aristotle. Osler [9] believes it possible that Linacre was in Venice between 1495 and 1497, but this seems unproved, and an earlier date seems more probable for his stay there.

While in Florence, Linacre continued under the renowned scholar Politian the Greek studies begun at Oxford. Angelo Poliziano, who latinized his name to Politianus, was born in 1454 and studied Greek under the Byzantine refugees Johannes Andronicus Callistus and Johannes Argyrophylus, and philosophy under Marsilio Ficino. He early gained the patronage of the Medici and taught Greek not only to Thomas Linacre and some of his English friends, but to Giovanni Medici, the future Pope Leo X. Politian died in 1494, the same year as Hermolaus Barbarus and Johannes Pico della Mirandola: [10] his morals have quite properly been condemned,[11] but his taste and genius reformed classical studies in Italy. Through him, Linacre met Lorenzo Medici, "The Magnificent," who

and Linacre had had no medical training before he left England, when he was about twenty-five. Moreover, it seems likely that both Linacre and Latimer spent some time helping to prepare the five volume Aldine edition of Aristotle, published between 1495 and 1498.

Dr. Loris Premuda, Professor of the History of Medicine in the University of Padua, was kind enough to send the present writer photostatic copies of the archives of the University pertaining to the graduation of *Thomas Anglicus*, clearly Linacre, as Doctor of Medicine on August 30th, 1496. The writer is indebted to Dom Anselm Strittmatter, Monk of St. Anselm's Priory, Washington, for help in deciphering a very difficult document.

[9] Osler, *op. cit.*, pp. 12-13.

[10] For a short account of Politian's stormy career, see Johnson, *op cit.*, pp. 109-115.

[11] Johnson, *op. cit.*, p. 116: *ferunt enim ingenui adolescentis insano amore percitum, facile in lethalem morbum incidisse.*

not only encouraged his studies but made him the companion of the princes Piero and Giovanni. In addition to Politian's tuition, Linacre studied briefly with the greatest hellenist of that, or perhaps any, time, Demetrius Chalcondyles.

We also know that Linacre visited the famous Nicolaus Leonicenus of Ferrara (1428-1524), probably the earliest of the medical humanists and author of one of the first clinical treatises on syphilis,[12] a disease which, whatever its origin, was then all but pandemic in Italy. Leonicenus had translated several of the works of Galen into Latin: one of them, *On the motion of the muscles*, was later published by Linacre, and all his long life Leonicenus looked upon Linacre as his pupil. It is likely that Leonicenus, confident in Linacre's soundness as a Greek scholar, gave him some drafts of his own Latin translations of Galen, hopeful that later discovery of better Greek manuscripts would permit clearer and more accurate translations by Linacre.[13]

Linacre left Venice for Padua where he was graduated as Doctor of Medicine: the course customarily extended over four or five years, and it was here that he must have acquired the greater part of his knowledge of medicine, since there is no record of any formal medical studies by Linacre before he went to Italy. Under the patronage of the Venetian Senate, Padua had well organized, supported, and staffed schools of medicine and anatomy, and it is possible that Linacre's later unsuccessful attempts to establish medical education at Oxford and Cambridge were based on his memories of Padua. There seems little evidence for the story that Linacre was offered a chair in the university medical faculty, and this is likely due to a confusion between the then loosely interchangeable Latin words *magister, professor*, and *doctor*. Linacre may or may not have returned to England, but in 1491 the University of Oxford followed the academic custom of the time in admitting him to its own doctorate in medicine.

Linacre's return to England

After his return from Italy, Linacre lived in Oxford in his college where he enjoyed much preeminence—not as a physician, it seems, for there is no evidence that he actually practiced very extensively at Oxford,

[12] The *Libellus de epidemia quam vulgo morbum Gallicum vocant*, published at Venice by the Aldine Press in 1497.

[13] J. F. Fulton, "Early medical humanists: Leonicenus, Linacre and Thomas Elyot," *New England J. Med.*, 1931, *205*: 141-146, 158-159. *See also* his "Medicine and the humanities: Linacre and Allbutt," *Tr. Am. Coll. Cardiology*, 1957, *7*: 24-37.

but as a Greek scholar. The revival of Greek studies which began in Italy had reached England, and Linacre, Grocyn, and Latimer were the leading hellenists of the time. Linacre read some lectures at Oxford, but whether on Greek or on medicine is not clear, though it is established that at this time Grocyn and Latimer gave public lectures to the university on Greek literature, and during his London years Linacre gave at least one course on Greek philosophy.

During his Oxford years, he formed a close friendship with his most famous pupil whose edition of the Greek text of the New Testament, dedicated to Pope Leo X and published in 1517, was one of the most influential books ever printed. After comparing the relative advantages of Italy and England for Greek studies, Desiderius Erasmus of Rotterdam (1466-1536) put off visiting Italy to go to Oxford and, after a short time in London, arrived on the scene in 1497. Erasmus lived in a house owned by his own order of Augustinian monks and studied Greek with Linacre, Grocyn, and Latimer: he had met Colet and More in London, and these friendships lasted all his life. After his return to Europe in 1499, he corresponded with them in Latin, for he does not seem to have been literate in any modern language, and has left interesting pictures of all their personalities except Linacre's. He considered Linacre, however, one of the three men in England competent to teach Greek and seems to have regarded his medical practice as incidental, although he was later glad enough to avail himself of his services during an attack of what seems to have been renal colic, which Erasmus attributed to a combination of English weather and English ale.

In 1501, a change came to Linacre's life when he was invited to serve as tutor to Prince Arthur, son of Henry VII, when he entered Magdalen College, but the prince died prematurely in 1503; concurrently with this, Linacre was appointed physician to King Henry VII in 1501 and, after the king's death in 1509, remained in London, where he soon developed a busy medical practice. This seems to have been a very absorbing career, and it is noted that " his friends complained to him of a too rigid economy in the distribution of his time, and urged him to occasional relaxation by a mutual intercourse and epistolary communication." [14] This complaint reveals a great deal about Linacre's capacity for work.

These years were marked by tremendous change in the intellectual climate of England, and the years between Linacre's first royal appoint-

[14] William Munk, *The Roll of the Royal College of Physicians of London*, second ed. (London, 1878), vol. I, p. 14.

ment and his retirement from active practice saw the replacement of the older scholastic modes of thought by the new humanism. While the more conservative clergy held on to medieval ways of thinking, the new humanist learning soon emerged triumphant. Linacre fared well: Henry VIII appointed him soon after his accession Royal Physician, a post of tremendous influence, but even amid a busy court and consulting practice, Linacre not only kept up his humane studies, but gave his very substantial aid to learning wherever and however he could.

Medical humanism properly had begun with Leonicenus of Ferrara who trained a group of young physicians in the methods and traditions of classical scholarship: some of them left medicine to devote their full energies to textual and literary criticism, while others—more antagonistic to the old scholasticism, perhaps, than it really deserved—determined that the best way to medical advance was through correct translations of medical and scientific writings into Latin and the various vernacular languages. In England Thomas Elyot, one of Linacre's students, was a prime mover, and the best known in France was François Rabelais, a busy Montpellier priest physician who not only wrote the *Gargantua and Pantagruel* but a scholarly commentary on Leonicenus' Latin translation of the *Aphorisms* of Hippocrates.

As in Western Europe generally, in sixteenth century England increasing numbers of scientific books were written in English, but their technical vocabulary was very cumbersome and often confusing because of a lack of English words equivalent to the classical Greek and Latin terms reintroduced during a period of rapid rediscovery and publication. These newly coined English words soon provided so much more confusion than clarity that what William Turner had contemptuously termed "inckhorne termes" in 1568 were almost completely supplanted in scientific use by words of Greco-Latin derivation by the end of the sixteenth century. Renaissance translations of classical scientific and medical works whether into Latin or into the vernacular thus founded the modern Greco-Latin medical vocabulary, the technical terms of which were gathered first into glossaries as appendices to individual vernacular works and, during the following century, into properly scientific dictionaries.[15] Although Latin continued as the language of medical writing through the eighteenth century, William Heberden (1710-1801), whom Dr. Samuel Johnson called "*ultimus Romanorum*, the last of our learned physicians"

[15] S. V. Larkey, "Scientific glossaries in sixteenth century English books," *Bull. Inst. Hist. Med.*, 1937, *5*: 105-114 ably discusses this topic.

and summoned to attend him in his last illness, was probably the last in England to write an important medical work in Latin; and Latin was gradually supplanted, if it has never been replaced, by modern languages, but not before its essentially latinized Greek medical nomenclature had securely established itself because of its eminently practical clarity, universality, and precision.

Linacre and the Royal College of Physicians

The practice of medicine gradually emerged as a function distinct from the Church during the later middle ages, but this does not suggest that all, or even most, medical practice had been in the hands of churchmen. Until the nineteenth century was well advanced, as those who recall George Eliot's novel *Middlemarch* appreciate, the regular medical profession in England embraced surgeons, apothecaries, and physicians; and, as always, during the fifteenth and sixteenth centuries considerable medical practice had been in the hands of individuals—midwives, itinerant stonecutters, oculists, bonesetters, root-and-herb men, and vagrant dentists, for example—whose scant training had been in the school of experience and who were licensed only by human credulity. Although a petition to regulate medical practice was placed before Parliament during the reign of Henry V,[16] it does not seem to have passed, and the Royal College of Physicians was the first effective British attempt to regulate medical practice by any body other than local ecclesiastical authority. At this time, physicians, usually masters of arts and doctors of medicine, were chiefly consultants, and general practice was done by surgeon-apothecaries whose training was by apprenticeship. Midwifery was left chiefly to the midwives. Then as now there was no scarcity of paramedical practitioners, and the lack of provision for examination and legal qualification made control of practice very difficult.

In continental Europe, university medical faculties and societies of physicians, usually under royal or state patronage and often with very considerable juridicial authority, had begun to solve this problem of medical licensure, but no such bodies existed in England before the Royal College. In part, this was due to the distance of the two Universities

[16] Johnson, *op. cit.*, p. 284, quotes Sir William Browne, *Vindication of the Royal College of Physicians* (London, 1753), p. 3, who "has given a copy of a petition, preserved amongst the Parliament Rolls, 9 Hen. V. for prohibiting all persons from the practice of medicine, except graduates from some University, with letters testimonial of their sufficiency, under pain of imprisonment and a fine of £50 to the King . . . No act, the consequence of this petition, is to be found in the printed copies of the statutes."

of Oxford and Cambridge, which alone conferred degrees in medicine, from the capital, so that if admission to medical practice were to be separated from graduation in medicine, it had to be through a body of examiners distinct from both university and church authorities.

The first substantial move in this direction was made in 1511 by an Act of Parliament, the preamble to which succinctly defines the problem:

> forasmuch as the science and cunning of physic and chirurgy to the perfect knowledge whereof be requisite both great learning and ready experience is daily in this realm exercised by great multitudes of ignorant persons of whom the greater part have no manner of insight into the same nor in any other kind of learning; some also can know no letters on the book, so far that common artificers as smiths, weavers, and women boldly and customarily take upon them great cures of things of great difficulty in the which they partly use sorcery and witchcraft, and partly apply such medicines unto the disease as be very noyous and are not meet therefor, to the high displeasure of God, great infamy to the faculty, and the grievous hurt, damage and destruction of many of the King's liege people, most especially of them that cannot discern the uncunning from the cunning.[17]

This act provided that no person might practice as a physician or surgeon in or within seven miles of the City of London without a license from the Bishop of London or the Dean of Saint Paul's Cathedral, who were required to call in suitably qualified physicians and surgeons to pass on the applicant's credentials and qualifications: elsewhere in England, authority to license medical practitioners was vested in the bishop with ordinary jurisdiction over the area. A few years later, control of licensure passed to the newly organized Royal College of Physicians, but English traditions die slowly, and the Archbishop of Canterbury had until a century ago the right to admit to practice by conferring a "Lambeth degree" by exercise of his authority to confer any degree in any university faculty.[18]

[17] 3 Henry VIII, c. 11, quoted by Payne, *op. cit.*, p. 26.

[18] Universities were first founded and conferred degrees under Papal authority, and after the Reformation this power to confer the doctorate in any university faculty was settled upon the Archbishop of Canterbury by the Act of Supremacy and Succession (25 Henry VIII, c. 21) in 1534. The official home of the Archbishop is Lambeth Palace, and such "graduates" wore the academic regalia of comparable degrees in the Archbishop's own university. The Lambeth degree in medicine was entirely legitimate and once had an equitable value since the Royal College of Physicians after 1675 restricted its license to graduates of British universities, and the Lambeth M. D. would qualify men for practice who had studied in continental universities but could not qualify for a British degree. Relatively few such degrees were conferred: probably the two most famous were two members of Archbishop Tillotson's "Class of 1691," Thomas Hobbs and Robert Hooke. The degree was last conferred in 1880 but has not been a "registrable" degree, that is, a degree admitting to practice, since 1857, and the Bishop of London had stopped

On 10 September, 1518, a royal charter was granted Thomas Linacre and Fernandus de Victoria, physicians to King Henry VIII, along with Nicholas Halsewell, John Francis, Robert Yaxley, and others, to form a College with specific authority to make statutes and ordinances for the "government and correction" not only of College members but of all regular medical practioners in London and within seven miles of the city. This charter prohibited from practice any person not a Doctor of Medicine of Oxford or Cambridge and not previously licensed by the President and College. Four persons were appointed each year to regulate such practitioners and to examine all drugs and were given power to punish offenders by fine and imprisonment surprisingly severe by modern standards.[19] Four years later [20] the authority of the College was extended in the same terms to all England, and although bishops continued in fact to license medical practitioners for another hundred fifty years, this Act of Parliament effectively removed control of medical practice from the hands of both university and church. Although a working medical practice act in the modern sense did not become effective until the middle of the nineteenth century, this early legislation had prepared the way.

Linacre was the first president of this College and held office until his death; its first meetings were held at his house in Knight Ryder Street, and he gave the College not only very considerable financial support, but—during his lifetime—his house and library as well. The latter gifts were destroyed during the fire of London, but in the words of Sir William Osler, himself a somewhat Linacrean character, "he left what has been much more valuable to English medicine—an example of a life of devotion to learning, to medicine and to the interests of humanity." [21] Linacre was responsible for guiding this College during its formative years, and the requirements for its membership were set at an impressively high standard: the degree of learning required was much higher, as subsequent controversies document, than those for graduation in medicine at the universities.

Nor did Linacre's interest in medical education stop with the Royal College of Physicians. From his own estate, he endowed three lectureships—what would amount to professorships today—in medicine, two at

licensing practitioners of medicine long before, in 1745. For a discussion of the M. D. (Lambeth), *see* Cecil Wall, "The Lambeth degrees," *Brit. M. J.*, 1935, *2*: 854-855 and the correspondence, *ibid.*, pp. 603-604, 703.

[19] *See* Johnson, *op. cit.*, pp. 279-282; the charter is 23 Sept. 10 Henry VIII.

[20] 14 and 15 Henry VIII, c. 5.

[21] Osler, *op. cit.*, p. 60.

Oxford and one at Cambridge: the *Diploma regium* confirming this is dated 12 October, 1524, just eight days before his death. His choice of trustees proved unfortunate since amid the many political and other upheavals of the time they were unable to carry out their duties—Thomas More, for example, was beheaded. These lectureships lapsed, although the revenues at Oxford were assigned during the reign of Edward VI to Merton College.[22] Linacre no doubt intended as a wise and generous man to found medical schools in England along the lines of those which existed in Italy, but the fate of his endowments is a classic study in educational mismanagement; medical education at the ancient British universities vegetated until the rise of the hospital medical schools in London during the first part of the nineteenth century.

Ordination and ecclesiastical career

Linacre was, like most Englishmen of his time, a Catholic: the Wycliffite movement provoked no very major defections in a land proud to style itself " Mary's Dower," and the complex causes of the Protestant Reformation did not yet preoccupy Christian men's thoughts. He had a Catholic upbringing and too little is known of his private life to say how devout or lax was his personal religious observance. It is somewhat surprising to *us* that when already a man of mature years, for he had never married, he began to study theology and to prepare himself for ordination to the priesthood. In his day, this was not an uncommon step—Marsilio Ficino, the reviver of Platonism during the Renaissance, had done the very same thing—and it still occurs from time to time. This has caused much comment by his biographers, though if his contemporaries thought this step unusual or even unexpected, no record of this has survived, and evaluation of his motives must depend ultimately upon conjecture.

No informed person any longer believes either that men before the Reformation encountered difficulty in gaining access to the scriptures, or that very many literate persons were unable to read the familiar Latin Vulgate text of the Bible: the often quoted account that Linacre shortly before his death read Matthew 5-7, which contain the Beatitudes and some of Our Lord's most unworldly teachings, for the first time and vowed " that either this was not the Gospel, or we were not Christians " [23]

[22] On the history of these lectureships, *see* Johnson, *op. cit.*, pp. 272-275.

[23] There are discussions of this apocryphal episode in Thomas Fuller, *The Worthies of England*, edited . . . by John Freeman (London, 1952), p. 112, and Johnson, *op. cit.*, pp. 189-191.

must surely be apocryphal. Any idea that Linacre's interest in the religious (as opposed to the lay) life at this mature age was a conversion from something to something else reflects some lack of awareness of the state of religion in Linacre's England: at that time, however real popular dissatisfaction may or may not have been with the disciplinary or temporal state of Catholicism in England, its sacramental and doctrinal authority was almost unquestioned and, if anything, taken too much for granted for its own good.

Yet it is hard to apply to Linacre's decision Walsh's doubtlessly true statement that "a man may, even when on in years, give up everything to which his life has been so far directed, and from a sense of duty give himself entirely to the attainment of 'the one thing necessary': "[24] the lack of evidence that he at any time undertook to perform in person any of the duties of his various ecclesiastical appointments, that he lived in London all his life, and that he seems always to have considered himself a physician rather than a priest are considerations which argue against motives of that intensity. After his ordination, Linacre quietly lived on in London, serving neither as a parish priest nor as a member of a cathedral chapter. He was not a monk, nor did he join any semi-monastic foundation, and the good works which Linacre accomplished as a clergyman[25] were not along the lines which are *now* considered to be the work of a priest or minister of the Church. That a sincerely believing Catholic man, free of family ties, eminent in medical and scholarly circles should take Holy Orders toward the end of his life is perfectly consistent human behavior, and what is known of Linacre's reputation for personal integrity makes bad faith or self-seeking quite unlikely.

In all likelihood, Linacre entered the Church under the auspices of his friend and patient, Archbishop William Warham, but much confusion exists as to the time, place, and prelate at his ordination—Warham or Cardinal Wolsey probably officiated, but the surviving registers of ordinations are silent for the time in question, which would have been no earlier than 1509, since Warham that October assigned him to the rectorship of Mersham in Kent, and in December, to the prebendary of Wells Cathedral;[26] but Payne is probably correct in concluding that he obtained

[24] J. J. Walsh, "An English physician priest at the eve of the Reformation," *American Ecclesiastical Review*, 1903, *29*: 145.

[25] *Ibid.*, pp. 159-160.

[26] On the authority of Tanner, *Bibliotheca Britannico-Hibernica*, which the present writer has not seen, J. F. Payne, *op. cit.*, p. 20, assigns Linacre's ordination to 22 December, 1520, and the prelate as the Bishop of London under the patronage of the

these appointments *in commendam* while still a layman, and that he was ordained in 1520,[27] a date in good agreement with Caius' epitaph. It is thought that the gratitude which Linacre mentions in the introduction to his 1521 translation of Galen's *On the temperaments* toward Pope Leo X, his old friend, pupil, and classmate, refers to a special dispensation from the customary reception of minor orders before those of a priest, but this also is conjectural. In the dedication of his translation of Galen's *On the natural faculties* to Archbishop Warham he states very simply that he took orders to obtain the leisure necessary for his scholarly work, and on the whole this is an uncomplicated explanation; but is it the whole one? He almost certainly had the revenue of his benefices before his ordination: although especially decried by the monastic orders and the more perceptive clergy, this was common both before and after Linacre's time. Ordination was not a necessary step to secure this income in days before endowed research foundations. Thomas More, the merriest of men, Lord Chancellor of England, intimate friend of the high and mighty, a wealthy and famous lawyer, an articulate judge ranked with Henry of Bracton and Sir John Fortescue, author not only of the *Utopia* but of some charming Latin bawdy verse, was probably never seriously expected to die on the scaffold, a martyr like Eleazar, for his religious convictions.

Linacre accepted and resigned many ecclesiastical appointments during the latter years of his life, and it seems that for physicians to hold these was an established medieval custom. Munk quotes a reason for this:

> the clergy applied themselves not a little to medicine, and such as gained celebrity were pretty certain of being retained by the nobility and the court, and were loaded with Church preferments. This arose to a very great abuse. These doctors on resigning a benefice often obtained, with the connivance of the bishops, an annual pension from the succeeding incumbent.[28]

Archbishop of Canterbury. Late December falls within the season for ordinations in the Roman Church, and the year is in good agreement with the *aliquot annos antequam obieret* of Keyes' epitaph. Johnson, *op. cit.*, pp. 192-193, gives a list of Linacre's church appointments.

[27] J. F. Payne, "Thomas Linacre," *Dictionary of National Biography* (London, 1893), vol. XXXIII, pp. 266-271.

[28] Munk, *op. cit.*, p. 16. The present writer, however, disagrees with Payne's remark (*DNB XXXIII*, p. 267) that "after receiving priest's orders there is no doubt that Linacre gave up practice and devoted himself to clerical life." Although Linacre gave up practice, as much as any physician ever can, he devoted himself to his translations of Galen, and there is no record that he served as a clergyman. However this may be, Catholic doctrine has always considered the good of a man's soul in itself a sufficient reason for reception of any sacrament; so that an active ministry, although usual, was not essential for a priest who was not a professed monk.

Considering Linacre's numerous warm friendships with highly placed Churchmen, it is not surprising that such methods may have been used to secure the income and leisure which he needed for his studies, and the bishops who helped in this are to be commended for their vision and not censured for venality: ecclesiastical preferment and lucrative benefices were often the reward for outstanding scholarship, and few men then questioned the wisdom or propriety of this custom. Tired, busy with a large practice, involved with problems of medical statesmanship, racked by the stone, and concerned with the revival of scholarship, classical no less than medical, he no doubt welcomed the freedom and financial support which these revenues afforded: it will be seen that his translations of Galen were published during the last seven years of life, after his virtual retirement from practice.

Linacre's published works

Linacre in fact has left almost no original work, if that term is restricted to *belles-lettres*. However Ciceronian the latinity of a few dedicatory letters and introductions, or impressive the choice of examples with which he illustrates his grammar, there is no single work to which the critic can point as a product of his own creative genius, and he usually appears as a grammarian or translator.[29] It is difficult to evaluate his creative ability on these grounds, and if Linacre's reputation rests upon his careful translations of Galen from the Greek into Latin, this estimation is reinforced by the unquestionably strong influence he had on such learned and critical men as Grocyn, Lily, Erasmus, and Melanchthon. Erasmus' judgment seems to have been well earned: *vir non exacti tantum sed severi iudicii*—"a man not only of exact but even of severe judgment."[30]

Linacre's first published translation was begun while he was in Italy

[29] Arturo Castiglioni (*A History of Medicine*, translated by E. B. Krumbhaar, 2nd ed., New York, 1947, p. 220) states that the first Latin translation of the complete works of Galen was that of Diomedes Bonardo, of Brescia, published at Venice in 1490, but he does not so much as mention Linacre in his excellent textbook, an omission hard to explain.

F. H. Garrison (*An Introduction to the History of Medicine*, 3rd ed., Philadelphia, 1922, p. 106) notes: "Of the many editions of Galen's works, the most important are the Aldine Greek text of 1525 (five volumes), the Basel edition of 1528, with the initial letter by Holbein, and the nine different editions of the Latin text published by the house of Giunta at Venice between the years 1541 and 1625. Of Latin translations, Conrad Gesner's (Basel, 1562), with the biographic illustrations on the title page and those of Linacre, are perhaps the most famous."

[30] Quoted by Payne, *op. cit.*, p. 35, and very many others.

and may have been revised or finished in England: Proclus' *On the sphere*, dedicated to Prince Arthur of England, was printed in a miscellaneous edition of the ancient astronomers by the Aldine Press in 1499, and many times reprinted.[81]

In 1517, the first of his translations of Galen appeared: *On the preservation of health*, dedicated to King Henry VIII, was handsomely published in folio by William Rubeus in Paris.[82] In 1519, Desiderius Maheu published, also at Paris, a folio again dedicated to Henry VIII, Galen's *A method of healing*: in the dedication to this work, Linacre states that he felt that this important book had not been translated into proper Latin up to that time, whether because of its prolixity or its obscurity, and that it fell to his lot to do this, to correct the barbarisms and mistakes which had crept in, to organize it into chapters, and to revise certain Arabist opinions.[83] This seems to have been the rationale of all his translations: not only to provide correct translations of a sound Greek text, but to clarify errors in interpretation based, in part, on an incorrect textual tradition.

Although his name is well known and often cited, knowledge of the writings of Galen during the middle ages was not very extensive whether at first hand or in translation, and for the most part the works then circulated under his name were neither genuine nor what Renaissance and modern readers would consider the most valuable. The surviving pre-salernitan manuscripts of Latin translations and compilations ascribed to Galen, for the original Greek manuscript textual tradition had a precarious enough survival in the Greek and Oriental world, represent for the most part the repetitious late Latin tradition of practical medical digests and manuals. Augusto Beccaria's recent survey of these manuscripts,[84] repre-

[81] *Proclus de sphaera* in *Astronomici veteres* (Venice, 1499), folio.

[82] *Galeni de sanitate tuenda libri sex Thoma Linacro Anglo interprete* (Paris, 1517), folio.

[83] *Galeni methodus medendi, vel de morbis curandis. Thomas Linacro Anglo interprete* (Paris, 1519), folio. In the dedication to King Henry VIII, Linacre states: "Affero enim nunc Galeni opus, in quo ille omnem, quae proprie de medendo instituitur, rationem complectitur. Opus plane arduum, et quod sive id ob subtilitatem suam, sive prolixitatem, mille iam annis nemo satis Latine, ne dicam ex tanti operis dignitate vertere (quod sciam) est aggressus: ut mihi plane dolenda studiosorum sors videatur, qui hactenus desyderio ejus partim barbaris quibusdam iisdemque malae fidei inversionibus, partim nudis rerum capitibus, Arabum quorundam arbitrio excerptus: omniaque non modo ratione, quae reluctantem lectore ducere, sed etiam quae haesitantem quoquo modo inhortari possit orbatis, incumbere sunt coacti."

[84] Augusto Beccaria, *I codici di medicina del periodo presalernitano* (Rome, 1956) gives a list of these early medical manuscripts; and C. G. Kühn, *Medicorum Graecorum Opera* . . . Vol. I (Leipzig, 1821), pp. lxvi *sq.* reviews early Galenic scholarship. *See also*,

senting what the medical world interpreted as Galen's clinical teaching before the Renaissance, lists thirteen "Galenic" manuscripts dated prior to the eleventh century and complete enough to interpret: of these, only four contain any part of Galen's words or ideas, and the large majority are spurious. Although Galen's name was known before the Renaissance in Western Europe, it is safe to assert that his works generally were not.

In 1521, the first of Linacre's works published in England appeared: a small quarto, printed by John Siberch at Cambridge and dedicated to Pope Leo X, Galen's *On the temperaments and on unequal temperament.*[35] The last three of his translations of Galen were published at Cambridge by Richard Pynson, who had learned his trade as an apprentice to William Caxton: in 1523, *On the natural faculties* and, without date but in 1523 or 1524, *On the interpretation of the pulses*, this work being dedicated to Cardinal Wolsey. *On the differences between symptoms* and two other translations of minor works were published in quarto just after Linacre's death in 1524,[36] and a preface to the reader was added paying tribute to Linacre's merits and character, noting the loss to medicine occasioned by his death. With few changes, these translations have become the text of Galen most commonly used.

Linacre, who seems to have been the original for Robert Browning's poem, "The Grammarian's Funeral," wrote two works on Latin grammar, one of which established him as the leading European grammarian for more than a century: the first was the *Rudiments*, published by Pynson in an undated quarto and later translated by the poet George Buchanan, published in Paris by Robert Etienne in 1533.[37] A vastly more important and influential work was his *On the emended structure of the Latin language*, a reference grammar standard for a century: this was first published by Pynson at London in 1524[38] and was frequently reprinted on the continent. Philip Melanchthon provided an introduction to one edition (1531), recommending its use in the schools of Germany.

Lynn Thorndyke, "Translations of works of Galen from the Greek by Niccolo da Reggio (c. 1308-1345)," *Byzantina metabyzantina*, 1946, *1*: 213-235.

[35] *Galeni Pergameni de temperamentis, et de inaequali intemperie libri tres Thoma Linacro Anglo interprete* (Cambridge, 1521), quarto.

[36] *Galeni Pergameni de naturalibus facultatibus libri tres. Tho. Linacro Anglo interprete* (London, 1523), quarto; *Galeni de pulsuum usu. Tho. Linacro interprete* (London, n. d.), quarto; *Galeni de symptomatibus . . . de symptomatum differentiis . . . et de causis* (London, 1524), quarto.

[37] *Rudimenta grammatices Thomae Linacri diligenter castigata denuo* (London, n. d.), quarto.

[38] *Thomae Linacri Britanni de emendata structura Latini sermonis libri sex* (London, 1524), quarto.

A few verses by Linacre are included in a *Linacri progymnasmata grammatices vulgaria*, published without place or date and containing verses by More, Lily, and others. The preface to the 1497 Aldine edition of Aristotle refers to "Thomas, an Englishman most learned in both Latin and Greek." [39]

Linacre's influence

The physician Galen, who lived a generation after Saint Paul, was an heir to five centuries of medical scholarship and enjoyed an unsurpassed reputation in ancient and medieval times: his works covered the known fields of medicine so thoroughly and so well that they soon became almost canonical in their authority. Accordingly, their influence was tremendous, whether directly or, as was more often the case, through Latin epitomes and abstracts. Greenwood notes:

> The first thing which occurs to a modern reader is that Galen was almost comically unlike one's idea of an oracle or a prophet. He had certainly two characteristics in common with the Hebrew prophets, viz. an extremely low opinion of most of his contemporaries and an immense command of the vocabulary of vituperation; also, at times, a beauty of phrasing which still glows faintly in translation.[40]

The influence of authority, Galen's and others, in Linacre's time was so complete that the physician's formal education, like that of students of philosophy, divinity, or law, was derived almost entirely from books as distinct from observation and experiment. Schools of practical anatomy had begun in Italy during the fourteenth century, but even this instruction in human anatomy was literary in that the dissection was at first used to illustrate the statements of classical writers on anatomy.

When Linacre went to Italy, he was keenly alert to the possibilities which would follow wider knowledge of Greek and had begun to master that language. The Greek manuscripts brought westward by refugees from the Eastern Empire and those which were gradually coming to light in the libraries of Western Europe formed a neglected vein of knowledge, much of which constituted a real advance upon what was then known. Greek scholarship had all but perished in Western Europe during the middle ages, and even so sound a humanist as Petrarch could not read Greek. During Linacre's lifetime, European society was stable enough and national boundaries open enough to permit easy travel; Latin was still a universally acquired second language among men of affairs no less

[39] *See* J. E. Sandys, *A History of Classical Scholarship* (Cambridge, 1908), vol. III, p. 226.

[40] Major Greenwood, *Authority in Medicine: Old and New* (Cambridge, 1943), p. 10.

than among scholars and scientists; and commerce drew large sums of money to the cities, much of which was channeled into the fine arts and scholarship. Most important of all, the invention of printing from type for the first time permitted widespread and economical reproduction both of the rediscovered classical texts and of original works. A combination of fortunate circumstances prepared the way for a real revival of learning, and if the importance of the Renaissance of the sixteenth century has often been overrated, it must not be underrated.

His studies in Italy made Linacre aware of the service which a return to the original Greek and, to a lesser extent, Latin sources could render all aspects of human thought. The anatomical and medical knowledge transmitted by the Arabs and particularly by the Arab commentators had established a school in the West of Arabist *Neoterici* which came to regard itself as the possessor of a complete body of knowledge. Its classical and valid origins had been diminished and changed by endless commentary and philosophical bias, and it had fallen upon the same evil days as scholastic philosophy and for what amounted to the same reasons. This body of knowledge, with a few Latin epitomes and translations of Galen and Hippocrates, was the basis of medical education in Linacre's time, but the principal place was held by the Arabist authorities. The first challenge to this Arabist school came in Italy where it met with the work of the medical humanists, the physician scholars, for as Sir George Newman notes:

> The Florentine Academy repudiated Arabist teaching. We must not forget that 450 years ago a training in medicine in Western Europe was comprised of a course of reading and disputation on Hippocrates, Galen and Avicenna. In the first year the student usually read the first Canon of Avicenna and the ninth book of Rhazes; in the second year the *Ars parva* of Galen, and the fourth book of Avicenna; in the third year the aphorisms of Hippocrates, the works of Dioscorides and commentaries on Avicenna. Medicine was taught as a branch of philosophy after the style of Averroes.[41]

[41] George Newman, *Linacre's Influence on English Medicine* (London, 1928), p. 9. Donald Campbell, "The medical curriculum of the universities of Europe in the sixteenth century with special reference to the Arabist tradition," *Science, Medicine and History:* Essays on the evolution of scientific thought and medical practice written in honour of Charles Singer (London, 1953), vol. I, pp. 357-367, reviews the medical textbooks prescribed at the Universities of Oxford, Leipzig, Tübingen, Vienna, and Frankfort-on-Oder and substantially agrees with Newman. He points out that most of the extant Greek manuscripts of medical works were copied after Latin translations of Arabic sources had been made, chiefly in the Saracen universities of Spain, and that the *Canon* of Avicenna remained a standard textbook at Montpellier and Louvain until the middle of the seventeenth century.

This revival of classical studies spread knowledge of the Greek and Latin writers, the best and most accurate authorities up to that time, in their full and correct form substantially as they had written during the classical age; and the medical humanists of the fifteenth and sixteenth century aided in spreading the results of the new learning in literature, philosophy, history, and natural science, no less than in medicine and anatomy. Their translations into vernacular languages helped to evolve the complex technical vocabularies of these languages: concepts are communicated chiefly through words, and the difference between a primitive and a civilized language is in the variety and precision of the concepts which it handles. The foundation of exact texts of these ancient writers may seem to be a useful task even today, but during Linacre's time, when each discovery of a previously unknown manuscript offered to extend the horizons of knowledge, literary research of this type was as exciting as any field of modern scientific or clinical investigation and was quite as productive of real scientific advance. It was with the hope that accurate texts and translations would add to knowledge and understanding to the benefit of humanity that these physicians devoted so much time and attention to their studies of such writers as Galen, whose names had long been known but whose works had survived in pseudonymous, abbreviated, or mutilated forms with their real meanings sometimes garbled beyond recognition. Linacre was among the most faithful and accurate of these translators.

Galen and Aristotle did not establish their own authority and even provided for its eventual displacement by new knowledge developed through the application of their anatomical and physiological techniques. When accurate texts and translations of their works became available, their observations were repeated, and inevitably many errors were found in their statements; but it is sometimes forgotten that time has vindicated *them* on some disputed points and that Vesalius and Harvey were Galenic in their approach to scientific problems, pointing out errors and misadversions without urging a complete break with the past.[42] Later, especially during the seventeenth century, political and theological forces led to condemnation of Galen and Aristotle unread as part of a wholesale attack

[42] This is appreciated by those familiar with the primary texts and sources involved but rarely understood by historians without adequate grasp of the classical languages or of the history of science. This problem is thoughtfully studied, for example, in papers by M. F. Ashley Montagu, "Vesalius and the Galenists," *Scient. Monthly*, 1955, *80*: 230-239, and Donald Fleming, "Galen on the motions of the blood in the heart and lungs," *Isis*, 1955, *46*: 14-21.

on all authority and to the loss of a just perspective on their solid contributions to the scientific and medical Renaissance.

Payne summarized the effects of the replacement by these corrected classical texts of the inaccurate second hand versions previously used:

> In the first place, the new authorities were actually much more valuable than the old, and in the second place the new dogma, instead of being merely conservative and petrifying, was found to be innovating and inspiriting in its tendency. Galen himself was not so strictly a Galenist as his followers. His works shew (in spite of his undeniable and fatal love of system and formula) enterprise and originality, with frequent reference to observation, and even experiment. They led also inevitably to a study of Hippocrates, a writer far more unsystematic, and free from the vice of formalism, whose sagacity and power of observation give his works a perennial freshness. . . .
>
> Haller, speaking of the progress of anatomy in the 16th century, attributes it to two chief causes, the revival of the works of Galen, and the invention of printing. Not less did Botany and Pharmacology take a new departure from the works of Dioscorides. . . .[43]

It seems doubtful that Linacre appreciated the importance to medicine of the revival of systematic studies of natural history, including anatomy and botany, which were beginning as experimental disciplines during his lifetime, and he contributed nothing of his own discovery to the science of medicine as such. Yet Singer is surely incorrect when he states that "he looked rather to the form than the substance of the works of the ancient writers."[44] Linacre, like many others of his generation, aided the advance of medicine by making available the actual texts of the best ancient authorities as a foundation upon which clinical observation and experimental investigation could begin a medical renaissance. This study of Galen was followed by a revival of the Hippocratic tradition of careful observation of clinical minutiae and case reporting, and through that by the clinical advances of the following centuries. The Greek and Latin texts so founded very often remained authorities in clinical medicine until the time of Sydenham and Boerhaave and beyond.

Fuller, in his delightful book, *The Worthies of England*, praises Linacre in terms which seem still valid:

> It is questionable whether he was a better Latinist or Grecian, a better grammarian or physician, a better scholar or man for his moral deportment. By his endeavours, Galen speaks better Latin in the translation, than he did Greek in the original. . . .[45]

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[43] Payne, *op. cit.*, pp. 42-43.

[44] Charles Singer, *A Short History of Anatomy from the Greeks to Harvey* (New York, 1957), p. 105.

[45] Fuller, *op. cit.*, p. 112.

This was Thomas Linacre: a shy and studious boy who had enjoyed one of the best and most thorough educations which ever fell to the lot of a man. While studying in Italy during the height of the Renaissance, he became interested in ancient medical writers and in their possible value for the medicine of his age. He studied medicine at the most distinguished medical school of his time and enjoyed a career of teaching and practice on intimate terms with the best minds of the English Renaissance. Exhausted by labor and illness, when well advanced in middle life and for reasons known only to himself, he was ordained a priest. His contribution to medicine was great and if viewed in the light of the needs and conditions of his age, must be ranked with the greatest. With the advancing artistic, literary, and philosophical forces which followed the revival of Greek scholarship and the invention of printing, he enrolled medicine. His work in the library as an editor and translator helped to spread a new understanding of ancient medicine which provided the basis for the more narrowly scientific achievements of the years to follow, and his solution of difficulties in medical education and licensure offered an answer to problems besetting the medical profession in these United States until the beginning of the twentieth century. His efforts to found proper medical schools failed because of the political unrest and religious strife in England immediately following his death, but the Royal College of Physicians is a monument to his efforts and, in a sense, the separation of an academic degree from a license to practice medicine is his doing. The combination of deep humane learning with eminent skill as a physician is an attractive part of medical tradition, and the steady advance of medical knowledge has been due, not only to careful investigators and brilliant innovators, but to men of Linacre's sound scholarship, broad insight, and personal integrity.

TEXTS AND DOCUMENTS

LOCKE'S ESSAY ON RESPIRATION

KENNETH DEWHURST

Amongst the Shaftesbury Papers at the Public Record Office are several medical essays in John Locke's handwriting. One of them, *De arte medica*[1] (1669), was first published by Fox-Bourne,[2] and later Gibson[3] reproduced a more accurate transcript. Another uncompleted essay, *Anatomie*[4] (1668), was intended to form part of the same treatise: it contains one sentence in Sydenham's handwriting, as also does *Tussis*[5] (undated). These three essays were written in English, whereas the fourth one, *Respirationis usus*[6] (undated) is in Latin and bears no trace of Sydenham's influence. It was probably written in 1666 or 1667, as Locke mentions the effects of a lack of fresh air on miners, which may refer to his visit in 1666, at Boyle's request, to the lead mines of Mendip in order to take some barometric readings. Also Locke's reference to "chemical remedies" at the beginning of this essay would indicate that he wrote it whilst still at Oxford where he was greatly influenced by such iatro-chemists as Willis and Boyle,[7] before Sydenham turned his interests towards studying the natural history of diseases.

Locke was at Oxford from 1652 until 1667. It was during these fifteen years that a brilliant band of scientists were busy casting off the bonds of Galenic dogma; and amongst those who were interested in various aspects of the physiology of respiration were Robert Boyle, John Mayow, Robert Hooke, and Richard Lower. The last named was Locke's old schoolfellow who introduced him to this group of experimentalists whilst still an undergraduate. But although Oxford was, at this time, seething

[1] P. R. O. 30/24/47/2, fols. 38-47.

[2] H. R. Fox-Bourne: *The Life of John Locke.* London: King, 1876, vol. 1, pp. 222-227.

[3] A. G. Gibson: *The Physician's Art.* Oxford: Clarendon Press, 1933, pp. 1-13.

[4] P. R. O. 30/24/47/2, reproduced by Kenneth Dewhurst in *Medical History,* 1958, *2*: 1-12.

[5] P. R. O. 30/42/2, vols. 31-34 (R), reproduced by Kenneth Dewhurst in *Bull. Hist. Med.*, 1959, *33*: 366-374.

[6] P. R. O. 30/42/2, fols. 35-36 (R).

[7] Boyle is described as an iatro-chemist insomuch as he constantly recommended chemical remedies whenever his work touched upon medicine. He was given the honorary degree of Doctor of Medicine at Oxford.

with experimental enquiry, the older views concerning respiration had not been swept away in spite of Harvey's discovery of the circulation some thirty years earlier. The Galenists believed that respiration served to cool the innate heat of the heart, whose pumping action removed foul vapours: it allowed air to mix with the blood in order to generate the vital spirits which were supposed to be present in the left ventricle. Both foul vapours and pure air were thought to flow in two separate channels through the pulmonary vein in spite of the fact that Harvey's work had demonstrated the absurdity of this notion. He had shown that venous blood was changed to arterial blood in its passage from the right to the left side of the heart. But what had brought about the change in colour, and what purpose did respiration serve? These were the main problems that interested Locke and his Oxford contemporaries.

Locke's interest in the physiology of respiration was mainly a theoretical one. His practical work was confined, for the most part, to preparing "chemical remedies," although his notebooks show that he carefully followed the experimental work of others, particularly Richard Lower. He also read widely in medicine and was greatly influenced by the works of van Helmont. Fermentation was the basis of all van Helmont's physiology. He believed that the blood was fermented in its passage through the lungs and by this process became lighter in colour and more volatile. A fifth fermentation giving rise to the vital spirits was supposed to take place in the left ventricle.

Members of the iatro-physical school had made more progress in explaining the mechanical aspects of respiration following Boyle's demonstration of the fundamental fact that air is essential for both life and combustion by showing that both were extinguished when he created even a partial vacuum. Boyle concluded his early experiments by stating that air was needed "to ventilate and cherish the vitall flame, which they do suppose to be continually burning in the heart." [8] In the following year, 1661, Malphigi described the minute structure of the lungs, and Borelli showed that air entered the lungs on account of a difference in pressure from that of the atmosphere, aided by expansion and contraction of the chest wall. But these mechanical observations failed to explain the nature of the physiological changes in the blood during respiration. It was Locke's friend Richard Lower (and to a lesser extent Robert Hooke) who made the most important contributions to this aspect of the problem.

[8] Robert Boyle: *New Experiments Physico-Mechanicall, Touching the Spring of the Air, and its Effects (Made for the most part with a New Pneumatical Engine)*. Oxford, 1660, p. 748.

They may well have worked together (until Hooke was appointed Curator of Experiments to the Royal Society in 1662), as they made similar observations about the same time. Unfortunately it is now difficult to reconstruct an accurate chronological sequence of events, as there was a long interval between their experimental work and its subsequent publication. It does seem, however, that after Boyle's pioneer work on respiration, Lower was one of the earliest investigators (although his main published work did not appear until 1669), for we find that as early as 1658 he was interested in explaining the difference in colour between venous and arterial blood. "Dr. Willis and Dick Lower opened a dogg," writes John Ward in his Diary,[9] "and they first let him blood in the jugulars to discover whether arterial and venal blood did differ in colour and constitution." He was still working at the same problem in June, 1664, when he informed Boyle that he was investigating "the reason for the different colour of the blood of the veins and arteries: the one being florid and purple red, the other dark and blackish."[10] More detailed notes of Lower's observations have recently come to light in one of Locke's medical notebooks,[11] which he began in 1664:

> Bloud taken out of the veines and arteries of the same creature at the same time very much differ, that that comes out of an opend veine being the greatest part of it of a dark colour which they commonly call crassamentum nigrum with a florid red about the thicknesse of halfe a crowne on the top. That which comes out of an opend arterie is all of that florid colour without any crassamentum nigrum.
>
> R. Lower.

A few pages later Locke records a much more important observation, to which Lower's initials are appended:—

> Bloud taken out of the artery of the lungs with its crassamentum nigrum like that which comes out of the veins soe that the red florid bloud is made only in the ventricle of the heart which is by the mixture of the aire with it which gives it volatilization and colour.
>
> R. L.[12]

And a third entry, written in shorthand, is to be found in Locke's memorandum book[13] for 1664: it is followed by Locke's initials and Lower's name which suggests that this experiment was their joint work.

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[9] Quoted in: Sir D'Arcy Power: "John Ward and his diary. Part 1." *Tr. M. Soc. London*, 1917, *40*: 15.

[10] Robert Boyle: *The Works of the Hon. Robert Boyle.* London: Millar, 1744, vol. V, pp. 523-524.

[11] MS Locke, f. 19, p. 212.

[12] MS Locke, f. 19, p. 226.

[13] MS Locke, f. 27, p. 13 (a).

Respiratio: Open a hole in each side of a dog and cut off the nerves that go to the diaphragm, the dog will die immediately. But if you cut off the eighth pair that go to the [lungs] [14] he will live two or three days. Bloud will be congealed in the vessells.

J. L. Mr. Lower.

A year later, 1665, Lower carried out the first blood transfusion; and he then went on to explode the Cartesian theory that the heart's movements depended on the blood flow by showing that a heart drained of blood still continued to beat.

Between 1661 and 1664 Robert Hooke also carried out a series of experiments on the physiology of respiration which were published in his *Micrographia* (1665). Therein he argued that air acted as a solvent for combustible bodies provided that they were sufficiently heated. Fire resulted from their dissolution, and was " made by a substance inherent, and mixed with the Air, that is like, if not the very same, with that which is fixt in Saltpeter." [15] At that time the chemists were greatly interested in the properties of nitre (potassium nitrate) in relation to respiration and combustion. It was prepared by exposing decaying animal or vegetable matter to the air, and it was thought to be formed partly from the earth (potash) and partly from the air (spiritus acidus). As it burned fiercely when mixed with sulphur, even in a vacuum, saltpetre came to be regarded as a substance which, either directly or in combination, played an important part in breathing and combustion. Boyle held a different view. He believed that both combustion and respiration depended on the presence of an unknown substance in the air which was not an ingredient of nitre, as he had clearly shown that air itself might be intercepted between the corpuscles composing nitre.

Hooke carried on with his experiments after the publication of *Micrographia*, and the *Philosophical Transactions* for the 21st October, 1667, came out with a paper entitled, " An account of an experiment made by Mr. Hook of preserving animals alive by blowing through their lungs with bellows," [16] which later gave a further impetus to Lower's investigations. After opening the thorax of a dog, Hooke blew air from a bellows into the trachea: the air escaped through puncture holes made in the outside of the lungs. This was the first demonstration of artificial respiration, and Hooke also showed that a continuous supply of fresh air (rather

[14] Transcript doubtful.

[15] Robert Hooke: *Micrographia; or some physiological Descriptions of Minute Bodies made by Magnifying Glasses with Observations and Enquiries Thereupon.* London: Martin and Allestry, 1665, p. 113.

[16] *Phil. Trans. Roy. Soc. Lond.*, 1667, Oct. 21, vol. III, No. 28, pp. 539-540.

than the pumping action of the heart) was essential to sustain life.[17] The same issue of the *Philosophical Transactions* contained a summary of Jan Swammerdam's *Tractatus . . . de respiratione usuque pulmonum*, wherein he made the important medico-legal observation that the lungs of newborn infants will float on water if respiration has taken place; but his explanation of the physiology of respiration was vague and completely out of date. He suggested, for example, that respiration served to refrigerate the blood "by separating its fuliginous steams, and so raise it to its ultimate and highest perfection, for the Conservation of the Life of Animals." [18]

At a later meeting of the Royal Society on the 27th April, 1668, Hooke remarked

> that blood, though of a dark blackish colour, would when exposed to the air, become presently very florid, and that florid surface being taken off and the subjacent part exposed again would acquire the like floridness and that therefore it might be worth observing by experiment whether the blood, when from the right ventricle of the heart it passes into the left coming out of the lungs, it hath not that tincture of floridness before it enters into the great artery: which if it should have, it would be an argument that some mixture of air in the blood in the lungs might give the floridness.[19]

Opposition to the logical and reasonable views of Lower and Hooke came from Walter Needham,[20] who rejected the idea of the "vital flame" and held instead that the air is received into the mass of blood, although he even doubted whether this process took place in the lungs.

But one of the most important landmarks in the history of pulmonary physiology was the publication of Lower's *Tractatus de corde* (1669) wherein he revised all his experimental work on the subject. At one time Lower thought that the difference between venous and arterial blood was due to fermentation in the heart, but later, he showed most effectively that the florid colour was not communicated to the blood in the left ventricle. He cut the larynx of a dog and put a cork in it, so that air could not get into the lungs. He then noticed that blood from the cervical artery was the same colour as that from the jugular vein of a suffocated dog; and also that blood from the left ventricle of a suffocated animal was always dark in colour. Venous blood taken from the right ventricle

[17] According to Mrs. G. Witheridge (personal communication), Harvey carried out this same experiment forty years earlier.

[18] *Phil. Trans. Roy. Soc. Lond.*, 1667, Oct. 21, vol. III, No. 28, 534-535.

[19] T. Birch: *History of the Royal Society*. London: Millar, 1756, vol. II, p. 274.

[20] Walter Needham: *Disquisitio anatomica de formato foetu*. London: Radulph Needham, 1667.

and forced through the vessels of the collapsed lungs of a strangulated dog returned from the pulmonary vein of a venous colour; but Lower found that when the lungs were kept inflated and perforated, as in Hooke's experiment, the blood from the pulmonary vein was bright scarlet. These differences in colour he attributed wholly to a change in the lungs. Lower gave the following summary of his experiments:—

> It appears, therefore, that this scarlet colour is wholly due to particles of air insinuating themselves into the bloud since it is returned florid throughout just as in the lungs; because in them the air diffused through all the particles of the bloud is mixd more intimately with it.[21]

Whilst Hooke, Lower, and Boyle were devising and carrying out new experiments, John Mayow, another Oxford man, was busy reading, writing, and listening to lectures. He read all the new works on the physiology of respiration, and although he was officially a law student, he also attended medical lectures which almost certainly included those given by Lower and Willis at Christ Church. Mayow quickly got his views on respiration into print, as his *Tractatus duo, etc.* came out in 1668. It contained nothing new as his opinions were largely based on the experimental data of Boyle, Hooke, and Lower, embellished with his own fanciful speculations. In 1674 Mayow published his *Tractatus quinque medico-physici, etc.*, wherein he uses the term "nitro-aerial spirit" (instead of "nitre" as in his first book) for the substance in the air which he regarded as being essential for respiration. This term had been used by Lower five years previously as being the particular substance in the air which was responsible for changing the colour of the blood. Mayow's contribution to the problems of respiration has been too highly rated until recently, when his writings have been placed in their true setting by Patterson [22] and later by McKie.[23]

These then were some of the main trends directed towards a proper understanding of the physiology of respiration whilst Locke was at Oxford. It is difficult to know just how much Lower, Mayow, Boyle, and Hooke knew about each other's experiments *before* their various works were published They were all constantly meeting one another, and it is highly likely that they were all well informed about the others'

[21] Richard Lower: *Tractatus de corde, etc.* London: Allestry, 1669, p. 52.

[22] T. S. Patterson: "John Mayow in Contemporary Setting." *Isis*, 1931, *15*: 47-96; 504-546.

[23] D. McKie: "Fire and the flamma vitalis: Boyle, Hooke and Mayow." In *Science, Medicine and History*, edited by E. A. Underwood. London, New York, Toronto: Oxford Univ. Press, 1953, vol. I, pp. 469-488.

progress. And it is even more difficult to judge the extent of Locke's knowledge of the evolution of respiratory physiology when he began writing this undated essay. It was almost certainly written before the books of Hooke, Lower, and Mayow came out, when Oxford was seething with ideas and experiments, but when the whole subject was still in a flux. Boyle's influence on Locke's essay can be plainly seen; and the latter's notebooks also show that he was carefully following Lower's work some four or five years before the publication of *Tractatus de corde*. The experimental work of Boyle and Lower was the most important contribution to the whole problem But Locke's essay, unlike the work of Boyle and Lower, does not break new ground. It contains some lingering ideas from the classical writers mingling freely with the then modern notions of "fermentations" and "effervescences" which were an iatro-chemical legacy.

The whole essay was written in an *a priori* rather than an empirical vein; and it was probably a hasty composition as Locke's handwriting is illegible in places. Also due allowance must be made for his ornate rhetorical Latin which lends an unscientific flavour to it. But in spite of Locke's vagueness and lack of experimental evidence, he at least had the wit to realise that respiration served a fundamental function in providing for cellular metabolism.

The English translation of the essay follows; the Latin text is appended.

The Purpose of Respiration

Are chemical remedies preferable to those of the Galenists? Yes. May we suppose there is a universal remedy? No. Are opposites cured by opposites? No.

That opposites are cured by opposites—a proposition, which is the basis as it were of all medical practice, being approved by antiquity and attested by experience—this has been often canvassed by authors elsewhere.

The cure of opposites by opposites is an axiom so well known and repeated so emphatically by every author, that up to this day it has been accepted by almost the whole medical profession as the foundation, as it were, of all medical practice, approved by antiquity and attested by experience. However this paper will show that this proposition was not a dogma among the early doctors nor founded on the facts of nature; and will disclose the true method of healing. On this subject there was bitter strife between the "chemists" and those who like to be called Galenists. For they contend that like is cured by like, relying as much

on the opinions of the ancients as on scientific facts; nature being opposed to disease.[24]

If we consider the mysteries of nature and also the properties of chemical distillations . . .[25] we must realise (1) what an essential function the air performs in fermentation and volatization, (2) how in closed vessels, into which no air can penetrate and from which the ordinary air is exhausted, it is impossible to volatize substances normally volatile and responsive to heat, however violent a fire you apply, (3) that some substances easily catch fire in the open air and on combustion disappear into flame and smoke; yet when shut into glass vessels exposed to extreme heat, they cannot be reduced further than the stage of cinders and mostly turn into fixed bones and death's head (like cinders and soot). It is uncertain what is the acid[26] in the air which thus breaks up solids into minute particles, volatizes them and burns them. It is probable that it is the air which consumes bodies and makes them burn, and not fire, which seems to be simply a very great agitation of the inveterate particles while the air is loosening and dissolving the bonds of the matter.

What, I repeat, is that salt in the air? To hazard a guess on such a difficult subject I could say that it is not the salt which has been noticed in bone but some highly volatile interior spirit which is the proper purgator of sulphurous[27] and inflammable substances;[28] especially considering that it is agreed that the volatile parts of the blood of animals leap about, and that clods of earth exposed to the rays of the sun ferment and give birth to . . . .[29] And I expect that the sun with its rays extracts the volatile salts from each clod of earth and mingles them with the air; and that these necessary agents for our life and for the volatizing of our blood are drawn in by us together with the air; hence the continual

[24] It would appear that this introduction wherein Locke reproduces the main differences between the Galenists and the iatro-chemists has only a remote connection with the physiology of respiration, although the page is headed "Respirationis usus." I can only conclude that this controversy (in which Locke was an ardent supporter of the iatro-chemists) coloured all his medical thinking at this time.

[25] The first two lines are illegible.

[26] A few lines later Locke uses the word "salt" instead of "acid" when referring to the same substance. At that time these terms were interchangeable and had not acquired their present narrow definitions, but were loosely used to describe any substance that was neither fully metallic nor distinctly liquid. When referring to this same substance, which we now know to be oxygen, Mayow used, at various times, the following three names:—sal nitro-aereum, spiritus nitro-aereus, and igneo-aereus particles.

[27] Locke uses 'sulphurous' in the sense of 'combustible.'

[28] This sentence shows that Locke had grasped the important point that combustion was brought about in the presence of some substance in the air.

[29] Indecipherable.

burning of the little flame of life in our heart.[20] This then is the nature of the air; and our life consists in perpetual generation and outflowing of spirits, i. e., in volatization of the mass of blood. This volatization takes place by fermentation and a kind of burning in the heart, but without air no such fermentation or burning or whatever we call it takes place. We conclude therefore that air serves rather to foster the heart's heat than to cool it.[21] This can be proved experimentally in daily life.

Anyone who can go into the subterranean mines and see there the frequent faintings, swoonings and finally deaths, unless open air aids them through the openings, will know that there was lack not of coldness of air to temper the heat of the heart, but of the particle of life which must be breathed in with the air. For unless new and fresh air is continually drawn in and circulated through the nostrils, those who are submerged in the bottom of the mines falter and faint, even though they take care that new and fresh draughts of air are continuously being brought down through ducts specially pushed out through the sides of the wells, whose openings are turned into the wind and pick up the air, which is driven by the blast and carried down to the workmen. If you block up the opening of this duct or even only turn it away from the wind, the circulation ceases and those who are below die.

This is often done for a joke, so that the air stagnates and the circulation ceases; the diggers underground soon feel the badness of the air and at once their pulse changes, their limbs droop, their strength fails, their heart trembles, and swooning and death follow unless a small draught of the breath of life is immediately supplied. This all happens not because of an excessive burning of the heart nor because of an improper temperature of the air, since these symptoms often occur when the air below is much colder than that on the surface of the earth, which is heated by the full rays of the sun and the burning dogstar. When there is deficiency of air, which is the agent by which the heart retains its heat and the mass of blood ferments, then the little flame of the heart for lack of fuel gradually dies down. Moreover, the flames of the lanterns falter at the same rate as the strength of the men who hold them.[22] I say that the flames weaken,

[20] Here Locke is referring to nitre (potassium nitrate) whose properties greatly intrigued 17th century chemists. Hooke and Mayow believed that the combustible part of the air was in some way related to nitre. Boyle disagreed with this view.

[21] This is opposite to the teaching of Galen.

[22] This passage about the effects of the lack of pure air in miners is probably based on Locke's own observations amongst the lead miners of Mendip which he describes in a letter to Boyle (cf. *The Works of the Hon. Robert Boyle,* MDCCLXXII, vol. VI, New ed., London, p. 686.)

sicken and finally die out, but no one claims that they die out from excessive heat of the air. The same thing happens in meetings of men in enclosed buildings where frequently the people who are weaker and of less solid make-up suffer from fainting, because the ferment of the enclosed air has largely been exhausted by so many dry lungs.

Is the first purpose of respiration the cooling of the heart? No.

Nowhere is nature more hidden from us than where she seems to show herself openly and obviously to us. That vital breath which from the beginning of our life to our last movement we incessantly labour to draw in and give out seems only to play with us. The internal locks of our heart are so much diffuse that it slips away and escapes the grasp of those at whom it first rushes, and with the same kind of fineness escapes the grasp of mind and eyes. That ambient aether, with which it is so important that we have commerce lest we die, we let it in as an unknown ungrateful guest, nor can we trace nor understand what it does nor whence it comes. Thus we draw in something dense and yet we soon breathe out aether. And that spirit which is formed into sounds and voices teaches the nature of other things and has its own ses. By this means it is that in such darkness those vital flames by which we are heated keep burning. It is so far hidden among the mysteries of nature whether our continual breathing fosters or checks our native fires. But if you weigh up everything more carefully you can scarcely believe that timid nature would have made these bellows of our lungs of such sort that they were liable to extinguish the flame.

1. Nature's aim seems to have been to foster that universal heat or fire of our life. For we live as long as we burn, and are nourished by the same fire which destroys us. And indeed would she not be overprodigal and remiss if she devised such great fires in us that she had continually to blow through us cold air to prevent our strength burning up? Hence in our bodies there are so many secret places for extracting and cooking various ferments of the intestines all of which seem to work together to produce something which can be burned so that the vital flame may have its fuel. This end seems particularly to be served by respiration. For there is such a close connexion between air and fire that nowhere will you find the heat of fire growing from internal principles if you have excluded air.[88] But to understand the nature of animal heat and of internal respiration we must take our investigations a little deeper. All are now

[88] This was well demonstrated by Locke's friend, Robert Boyle, who by means of his air pump showed that even a partial vacuum extinguished both life and flame.

agreed that the life of animals consists in continual generation and flux of fine spirits. It is certain that these spirits are generated without the heat and fermentation of the heart by means of the digestions of what is ingested in the stomach, intestines, mesentery and other laboratories. But you ask what is the part played in this by air and respiration? Briefly, all this apparatus is useless, and the other organs perform their functions and prepare their foods in vain, unless finally a mixture of air is added and feeds the ever-burning furnace. For that is the hinge of animal life, that there should be a continuous and constant provision of animal spirits, that is that the parts of the blood should be changed into a subtle and volatile material, which is diffused everywhere throughout our arteries and nerves and imparts motion, feeling and heat to the body; this appears to be the formal reason and whole driving force of our life. After this mixing of the blood has played its part, it departs, is breathed out and flies into the air, giving place to the succeeding spirits; and thus the mass of blood by constant circulation through the heart and lungs gives rise to the vital flame and at length, become wholly volatile and leaving no dregs behind it changes into the nature of spirits and is blown away and evaporated through respiration; in which process air is essential.

Bodies of a thinner constitution not supplied with a continual flow of air do not seem able to be further kindled. For air seems to be like a thing saturated with some dye. For it can be observed in all solvents that when a certain solution is reached additional bodies are no longer dissolved; anything you throw in after that point sinks, untouched and unchanged, to the bottom. For the same reason a dense crowd of people shut in the same place, when there is very little entrance for the outside air, saturates the enclosed air by the constant breathing so that it is less suitable for refining and dissolving the mass of the blood and scarcely suffices to feed the little flame of the heart.[84]

There are many other factors which contribute to strengthen this supposition. No animals are ever so quickly killed as by blocking of their respiration. Thus if you take any animal and cut the nerves leading to the diaphragm, which chiefly aid respiration, the animal dies on the spot as though struck from heaven. The inhabitants of the frozen north often die of cold but never of heat; but they are always breathing. No one when he stops breathing gets hotter. In hot countries frogs and every

[84] Locke's preoccupation with "feeding the flame of the heart" shows that he has not completely thrown off Galenic influences, and his interest in the heart's role during "fermentation" of the blood also shows van Helmont's influence upon him.

type of serpent remain cold enough yet never cease to breathe, and fish, though naturally protected from burning by the great ocean in which they live, yet without the help of air cannot exist. These and many other examples point in the same direction; but this is not the time and place to investigate them more accurately and to explain them in more detail. But before going inside we must remove a doubtful point we meet on the threshold; namely, if the purpose of respiration is not to cool the heart, how is it that respiration increases along with internal heat?

A variety of answers must be given to this objection as the fact mentioned has a variety of causes. Men get too hot for two reasons: either fever or exercise and work can kindle heat.

1. Bodily work and exercise, by which men get heated, is caused by the two-way motion of many muscles. While muscles are moving they are stretched and grow hard and then compress the nearby veins and so propel the blood towards the chambers of the heart with an unusual speed; this blood flows into the ventricles of the heart and is expelled by the normal contraction of the heart. For when a viscuous substance is injected by syringe in a tepid fluid it is at once ejected; this shows that all exercise causes a more rapid circulation of the blood, and especially when the movement brings into play more muscles of the body, as in running, wrestling and such like.[35] The blood's circular movement being thus speeded up, respiration must also become quicker, not for the purpose of cooling, but principally so that the quickened blood may have free passage through the lungs. For unless the two lungs are drawn up and exercised by the admission of air, the vessels are squeezed by the flabby lungs and hinder the flow of blood from the right to the left ventricle of the heart.

2. So that, depending on the quantity of blood, no crude blood lacking in that ferment, deadly and unsuited for nourishment and life,[36] is sent to the brain (and other centres of bodily functions).

Why respiration increases in the heat of fevers can be partly seen from what we have said above. Many other factors could be adduced to back up this argument (which would need a dissertation in themselves and an Appendix "On the Nature of Fevers"). But this one fact we will add here: that though in fevers respiration seems to be hindered yet the

[35] Locke's reference to the technique of injecting substances into the blood as a means of studying the circulation of the blood was developed by his Oxford contemporaries, notably Wren, Hooke, Boyle, and Lower.

[36] This passage suggests that Locke did, in a vague way, realise that respiration was essential for cerebral function and general metabolism.

remains of the burned up blood can be dispersed and evacuated through the pores of the skin. However an increased rate of respiration supplies this defect and gives an exit through the lungs to these harmful waste products.

It all comes down to this: for whatever reason the circulation of the blood is increased respiration must increase correspondingly, to prevent the hollows of the lungs getting blocked and the right ventricle of the heart being overwhelmed by too great a flood of blood.

The heat of fevers and the heat caused by exercise seem to have this difference: the latter seem to spring from the motion of the muscles, the former from a preternatural movement of the overstimulated heart; and so respiration increases, not to check the fire, but to meet the needs of the hurrying blood, which, in order to preserve the whole, strives with loving sympathy and silent interchange to bring help to all the parts which are struggling just as it is itself.

These additional points might be made.

1. [Blank in MS].

2. Although perhaps in fevers the loosening of the bonds of the blood makes it too prone to effervescence.[37] In that unbalanced mixture, (although most people exhale a kind of taste) a few spirits are generated which admirably serve the economy of the body; and so it is necessary that the increased respiration should occasion a ferment of the air. We believe that it is possible that in this great disturbance of the air spirits are generated which are beneficial and of the proper temper.

3. Respiration increases because that irregular movement of the spirits, which in fever agitates the heart, causes more frequent vibrations of the diaphragm and lungs whence comes respiration.

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[37] The word "effervescence" suggests that Locke knew about the works of Sylvius.

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Appendix

Respirationis Usus.

An chymia remedia Galenicis anteferenda? Assentio. Detur medicina universalis ? Nego. An contraria contrariis curantur ? Nego.

Hoc quod tamquam totius medicinae practicae fundamentum et veterum consensu et rerum usu stabilitum, contraria scilicet contrariis curari, aliunde ab autoribus iactatum fuit.

Contraria contrariis curari adeo notum et omnium ore iactatum axioma ut nihil notius, adeo ut hactenus tamquam totius medicinae practicae fundamentum et veterum consensu et rerum usu stabilitum ab universa paene asclepiada familia receptum fuit. Verum enimvero illud nec veteris medicinae fuisse dogma nec natura institutum, et vera methodus medendi ex sequentibus patebit. Hac de re arduum fuit bellum inter chymicos aliosque qui Galenici dici amant. Similia nam similibus curari contendunt illi ex veterum placitis non minus quam re ipsa, natura quae morbo adversatur.

..... in mysteriis naturae ..... et in distillationibus chymicis ..... sciat necesse est, necessariusque sit aeris interventus ad res et fermentandas et volatizandas, quamque impossibile sit in vasis clausis unde excluditur aeris affluxus et amovetur aer communis per se satis concreta volatilia et flammis opportuna, vehementissima licet ignis tortura, volatilia reddere, quaeque in aperto aere facile deflagrant et cum combustantur tota in flammas aerasque evolant, eadem visceribus vitreis inclusa et summis ignis gradibus vexata vix in carbones nec ultra possis reducere; maxima parte in ossum fixum sive caput mortuum digruerunt (sic carbo fuligo). Quid acetum sit in aere quod corpora in partes ita agitat subtile et volatizat accendatque incertum. Probabile nam aerem esse quae corpora consumit et ardere facit, non ignem qui nihil aliud esse videtur quam partium inveterarum maxima agitatio dum aer rerum compagem laxat distringitque.

Quid inquam illud in aere salis sit, si quid in tanta obscuritate conjicere licet necesse spiritum quemdam introrsum summo volatilem (non in osteo observatam salem), qui corporum sulphureorum et inflammabilium esse menstruum appropria-

tum; praesertim cum constat salire animalium volatiles sanguinis partes et glebas terrae radiis solaribus expositas confermentatas interne praegignere. Providoque solem agere sales volatiles ex quavis terrae gleba radiis suis et acetum extrahere exaltere et aeri immiscere; quos ad vitam nostram cruorem sanguinemque nostrum volatizandum necessarios una cum aere haurimus et imbibimus, unde in corde incenditur continuo vitae igniculus. Sic igitur sese aer habet; vita nostra consistit in perpetua spirituum generatione et effluxu, i. e. massae sanguineae volatizatio. Volatizatio fit fermentatione et quasi accensione in corde; nulla autem huiusmodi fit accensio sive fermentatio sive quicquid aliud vocari licet nisi ex aere. Concludimus igitur aerem potius efficientem fomitumque esse caloris cordis potius quam refrigorium. Quod in vita quotidiana experimento aliunde constat.

Si quis mineralium fodinas adire possit et frequentes illic hypothymias syncopos et, nisi apertum subveniatur ....., exitus, sciet non frigidatem aeris qua calor cordis temperetur defuisse sed particulum illud vitae quod una cum aere inspirari debuit. Nisi nam per hibos ..... novus continuo recensque derivetur aer et quasi circulatio fiat deficient et delinquent qui in fundo illo demerguntur, quamquam cavent sibi ut deferatur continuo novi recentisque aeris haustus per canales in puteorum lateribus ad id extruatos, quorum orificia flanti vento obversa excipiunt aerem flatibus impulsum deducuntque ad operarios. Id si huis canalis foramen obturis vel modo a vento avertas ita circulatio cessit intereuntque qui subter sunt.

Quod saepe per lusum iocumque fieri solet, ita ut aer stagnat cessatque illius circulatio; demersi ibi fossores aeris vitium sentiunt quorum statim immutatur pulsus, labescunt artus, deficiunt vires, tremit cor, et lypothymia et mors irrepit nisi aurae vitalis parvus affluxus statim suppeditatur. Quae omnia non ex male habito cordis incendio et indebito aeris temperamento fiunt, quod haec symptomata saepissime eveniunt cum aer inferior longe frigidior sit quam qui eodem tempore insuper hac terra solis ardentibus radiis et aestuante syrio incalescet. Quod vero pabuli aeris defectus, quo calor cordis teneri et sanguinis massa fermentescere debet, cordis igniculum quasi substracto fomite paulatim extinguit ..... lanternarum illis in tenebris adventium flammae pari passu quo hominum illic depositorum vires languescunt; ipsae inquam flammae extenuantur marcescunt et tandem protinus emoriuntur, quas nimis aeris calore extingui nemo comperit. Idem saepe evenit in hominum conventibus aedificio quovis arte conclusis, ubi non raro debilioris et rarioris texturae homines deliquium patiuntur, aeris inclusi fermento a tot aridis pulmonibus majore ex parte exhausto.

An primarius respirationis usus sit refrigeratio cordis ? Nego.

Nusquam magis nos latet fallitque natura quam ubi palam prodire et cuivis obviam facillime se tradere videtur. Aura illa vitalis, quam a primordio vitae ad ultimum cordis tremitum continuo labore haurimus et reddimus nobis solum illudere videtur. Internae serae cordis ingerit sed tantum est elabatur et eos in quos prima ruit fallit amplexus, eademque subtilitate et mentis et oculorum fregit aciem. Aetherum illum circumfluum, quocum tantum nobis commercium est quominus obolimus, tamquam ignotum ingrate hospitem admittimus intro obiciendum, nec quis quid agat vel quorsum veniat indagare possumus aut omnino intellegimus. Sic quoddam haurimus spissum nihilominusque mox efflamus aether ..... spiritusque ille qui in sonos vocemque formatur docuit aliarum rerum naturam et usus tenuit suos. Huic est quod tantis in tenebris ardent illae quibus incalescimus flammae vitales. Hactenus est inter provectiones naturae mystos an creber noster

anhelitus nativos vel incendunt vel cohibent ignes. Licet accuratius omnia perpendenti vix videtur pavidam naturam ad extinguendam flammam faciles pulmonum fabricasse follos.

1°. Quia in eo laborare videtur natura ut universalis illa vitae nostrae foveatur calor ignis. Tamdiu nam vivimus tamdiu ardemus, et eodem quod nos confecit nutrimur incendio. Et sane non male prodige esset ac remissa si tantos in nobis extruxit focos ut continuo sibi necesse foret frigida transpirare ne incenderentur vires. Hinc tot in corpore depositionum coctionumque arcinae, hinc tam variae viscorum fermentae; quae haec omnia conspirare videntur ut sit tandem aliquid quod accendi possit fomitumque habet flamma vitalis. Cui usui prae omnibus respiratio servire videtur. Tanta nam aerem inter ignemque tanta intercedit necessitudo ut nullubi igneum reperias calorem ab internis principiis crescentem unde aerem excluseris. Sed ut animalis caloris natura et interioris respirationis melius intelligitur paulo altius res rejicienda est. Vita animalium in continua spirituum subtilium generatione et fluxu consistere apud omnes iam in confesso est. Isti spiritus cordis sine calore sine fermentatione generari rerum ingestarum in stomacho intestinis mesenterio aliisque officinis digestione constat. Verum interrogare queas quid ad hoc aer et respiratio. Dicam breviter; inutile prorsus est totum hunc apparatum et alia viscera frustra mutuas tradere operas et alimenta elaborare, nisi ultimo accedat aeris mistura et continuo affluxu perennos nutriat focos. Cum enim in eo quasi in cardine versatur vita animalis, ut continuus constansque fiat provectus spirituum animalium, hoc est ut sanguinis partes in materiam subtilem et volatilem exaltentur ..... quae per arterios nervosque undique diffusa corpori motum sensum et calorem impertiat; in quo ipsa vitae nostrae ratio formalis vigorque totus consistere videtur. Postquam inquam scaenam suam peregerit haec sanguinis crasis exibit tandem transpiratur et in aures evolet, succedentibus spiritibus locum praebens; et ita sanguinis massa repetitis per cor et pulmones circuitionibus flammae vitali materiam praebet et tota tandem volatilis facta, nulla relicta faece, in spirituum naturam transmutata per διαπνοην difflatur et evanescit; quod nunquam fieri posset sine aere.

Rarioris habitus corpora, non assiduo suppeditata aeris affluxu accendi ultra non possunt. Aer nam menstruo tinctura aliqua saturato similis videtur. Id enim in omnibus solventibus observari licet, nempe quod ultra certam properationem corpora sibi injecta non solvuntur ..... Quicquid nam postea injicias intactum prorsus et immutatum ad fundum subsidet. Pari sane ratione confertissima hominum turba in eundem locum conclusa ubi minus librum est cum aere externo commercium aerem inclusum frequenti anhelitu saturat, adeo ut postea, exaltandae et solvendae sanguinis massae minus idonea, ad accendendam cordis flammulam vix sufficiat.

Multa alia sunt quae huic opinioni stabilienda conducunt. Quod nunquam animalia vix aliqua arte tam cito extinguuntur quam impedita respiratione. Sic si animalis cuiusdam nervos ad diaphragma praetentos respirationemque maxime inservientes praecidas animal dictum citius quasi de caelo tactum interiit. Quique glaciali poli vicini frigore saepe calore numquam extinguuntur, semper tamen respirant. Nemo intermissa respiratione calidior evadit. Hypercaustae ranae et serpentium omne genus manet satis frigidum et nimio calore sollicitatum nunquam respirare desinit; piscesque quibus a natura, ne incendio deflagrant, toto Oceano satis cautum est; sine aeris beneficio vivere tamen non possunt. Haec et plurima alia huc spectantia accuratius perpendere et fusius explicare huius loci et temporis

ratio non patitur. Sed priusquam mansionem intramus liceat dubium aliquid in limine obvium amovere; scirelicet, si respirationis usus non sit cordis refrigorium, qui fit quod una cum interna calore augeatur et respiratio?

Huic obiectioni pro varietate causarum varie respondendum est. Duplice de causa solent homines nimium incalescere: vel febris vel exercitium laborque calorem accendunt.

1°. Labor corporis exercitiumque quo homines incalescunt fit plurimorum musculorum alterno motu. Musculi vero dum motum peragunt tenduntur et indurescunt proindeque vicinas comprimunt venas adeoque sanguinem ad cordis thalamos cursu praeter consuetudinem rapido propellunt, qui in cordis ventriculos illapsus naturali cordis contractione ejicitur. ..... Viscum nam tepido liquore injectum syringis statim ejaculatur; unde constat ex omni exercitio sanguinis circulationem celeriorem fieri, et eo magis quo motus plures exercet corporis musculos, uti in cursu lucta et similibus. Sanguinis igitur motus circularis ita auctus necesse est augeri simul respirationem, non ad refrigorium sed primo ut properanti sanguini detur liber commeatus et per pulmones transitus. Nisi nam per repetitam aeris admissionem attollerentur exercenturque duo pulmones, vasa flaccidis pulmonibus compressa cursum sanguinis a dextro ad sinistrum cordis ventriculum impedirent.

2°. Ut pro quantitate sanguinis non cruor sine isto fermento crudus cadaverosus et ad nutritionem vitamque parum idoneus ad cerebrum aliasque functionum officinas dimitteretur.

In febrium vero ardoribus cur aucta sit respiratio ex supra dictis ratio partim peti potest; cui etsi alia ad hoc spectantia adduci possunt (quae explicatio dissertationem exposcit et de febrium natura παρεκβασις), hoc unum adderem quod, cum in febribus impedita uti videtur est transpiratio, deflagrantis sanguinis exuviae per cutis porulos satis commode difflari et excerni possunt. Aucta respiratio hunc supplet defectum et effluviis istis nimium molestis per pulmones praebet exitum.

Huc demum tota res redit: quaecumque de causa acceleratur sanguinis circulatio necesse est pari passu festinare respirationem ne nimia cruoris inundatione occlusis pulmonum alveolis obruatur dexter cordis ventriculus.

Hoc solum inter calorem febrilem et exercitii interesse videtur, quod hic a musculorum motu, ille a praeternaturali cordis irritati motu incipere videtur; adeoque respirationem auctam non ad incendium cohibendum sed ex necessitate ortam festinantis sanguinis, quae omnes partes sibi invicem laborantibus mutua amicitia et tacita inspiratione subvenire ad totius conservationem nititur.

Haec paucula addam.

1° (blank in MS)

2°. Quod etsi forsan in febribus soluta sanguinis compages ad effervescendum nimis sit idonea, in ista tamen dyscrasi quamquam plurimi genus exhalent saporis, pauci tamen generantur spiritus oeconomiae corporis apte inservientes; necesse itaque est ut aucta respiratio aeris fermentum administrat; quare, uti opiniamur, fieri potest ut tanta aerum perturbatione mansueti et rectae indolis spiritus generentur.

3°. Respiratio augetur quia motus ille spirituum anomia qui in febribus cor agitat idem etiam diafragma et pulmones crebriore vibratione consentiat unde est respiratio.

NOTES AND COMMENTS

PARACELSUS AND TECHELLUS THE JEW

WALTER PAGEL

In his qualified censure of Paracelsus, Daniel Sennert takes him to task for his leanings towards magic—as indicated for example by the words of praise which Paracelsus and his followers found for Techellus.[1]

Techellus is indeed mentioned in the Paracelsean Corpus as "a great teacher in Israel and true naturalist." He is given great credit as the only extant pure source of the very ancient knowledge of the magic effects of stones with carved images. Most of this "Highest Art, Magica and Cabalia" fell into oblivion, owing to "inexperienced and wanton sophists" who would not heed the fact that God revealed more in the Light of Nature to His people, the Israelites, than to anybody else after the time of Christ. Techellus was despised because he was a Jew, and for this reason only a small part of his works has been preserved.[2]

This praise accorded to a Jewish naturalist forms a remarkable contrast to the many passages in which Paracelsus denies to the Jews any originality and merit in Medicine.[3]

On the other hand, the same Paracelsus said that Christians surpassed the Jews in lying—a vice to which Greeks (including Aristotle) had an

[1] Daniel Sennert, *De chymicorum cum Aristotelicis et Galenicis consensu ac dissensu* (1629). Paris, 1663, IV, p. 50.

[2] *Liber principiorum Theophrasti Paracelsi*, cap. 5, ed. Sudhoff, vol. XIV, p. 503. In: *De pestilitate*, ed. Sudhoff, vol. XIV, p. 597, the "Techellische Philosophia" is credited with the indication of a seventh point at which plague manifests itself in the human body—in addition to the six points already known. In the Huser Folio edition, Strasburg, 1616, vol. I, p. 326, the word "*techellisch*" is replaced by "*tellurisch*."

[3] According to Paracelsus, there is no ancient Hebrew tradition in medicine. God taught it to all peoples and in all tongues: *Von den Imposturen* (*Von der französischen Krankheit drei Bücher Para*), 1529, lib. I, cap. 14, lib. II, cap. 15, ed. Sudhoff, vol. VII, pp. 98, 127. Even the Kabbalah, so often extolled by Paracelsus as the source of knowledge of the Invisible, was according to him not an original Jewish achievement, but Persian in origin and only adulterated by the Jews: *Philosophia sagax*, lib. I, cap. 6. Probatio in scientiam necromanticam, ed. Sudhoff, vol. XII, p. 156. Against Rabbi Moses and his book "Nebolohu": *Von den Imposturen*, lib. I, cap. 14, *loc. cit.*, p. 98; *Drei Bücher der Wundarznei Bertheonei*. Vorrede, ed. Sudhoff, vol. VI, pp. 45-46.

inborn inclination.[4] In fact, all that Paracelsus has to say against the Jews accords with his attitude towards contemporaries and ancient medicine in general and does not necessarily contradict the praise granted to Jewish mysticism and Kabbalah—currents as unorthodox as his own philosophy.

Techellus only occurs, however, in two treatises that are strongly suspected of being spurious.[5] The very restriction of Techellus references may support the suspicion—more so than the contradiction between the praise accorded to this Jewish naturalist and the deprecation of Jewish medicine in general, for the Paracelsean treatises abound with contradictory statements.

At all events, Techellus has a place in the Paracelsean Corpus connecting him with a literary question of some importance, namely the spuriousness of at least one treatise. This justifies the question: *Who was Techellus?*

The answer is provided by Conrad of Megenberg's *Buch der Natur* from the middle of the fourteenth century. For a detailed account of this work and its author the reader is referred to Ludwig Choulant's *Graphische Incunabeln für Naturgeschichte und Medicin.*[6] The eleventh book of Megenberg is dedicated to stones and metals and contains a chapter on stones with carved images. This is followed by the *Techelsbüchlein* on the same subject—it is called "*büchlein eines grossen meisters in der jüdischheit der hiesz Techel.*" This is almost verbally the reference found in the *Liber Principiorum Theophrasti Paracelsi.* Moreover, like the author of the latter, Megenberg defends Techellus against his own "master"—the author of the original work in Latin which Megenberg purports to translate: Thomas of Cantimpré. In fact this is one of the pieces of evidence which, according to Choulant, show that Megenberg did not

[4] Draft for the dedication of a book on syphilis to King Ferdinand, possibly for the IVth part of the *Wundarznei,* ed. Sudhoff, vol. X, p. 485. *Grosse Wundarznei,* lib. II, tract. 2, "Beschlussred," ed. Sudhoff, vol. X, p. 347.

[5] The *Liber principiorum,* first appearing in 1570 and treating of Snakes and Spiders, was, according to Sudhoff, a product of the stir created by the publication of the *Archidoxis* (the "Archidoxensturm") which made any Paracelsean item—however spurious—a highly coveted possession (Paracelsus Edition, vol. XIV, pp. XXVIII-XXIX). As long ago as 1889 Sudhoff admitted, however, that some general terms in this treatise are very much reminiscent of Paracelsus' manner (E. Schubert und K. Sudhoff: *Paracelsus Forschungen,* II, Frankfurt a.M., 1889, p. 137, note). *See also*: K. Sudhoff: *Bibliographia Paracelsica,* Berlin, 1894 (repr. Graz, 1958), p. 181 sub No. 113, p. 208 sub No. 124.

[6] Leipzig, 1858, pp. 99-122. For more recent literature on Conrad von Megenberg, (c. 1309-1374), George Sarton, *Introduction to the History of Science,* Baltimore: Williams and Wilkins, 1927-1948, vol. III, 1947, p. 817, may be consulted.

content himself with merely translating this work. Arguing against Megenberg, siding with Techellus, maintains that they can be natural.[7] Techellus, Thomas had regarded all carved stones as the products of art.

The author of the *Liber Principiorum Paracelsi* therefore appears to have used as his source the work of Megenberg in which also much material was to be found about his main subject: Snakes and Spiders.

Thomas said that he appended to his work his translation into Latin of a treatise by a Jewish naturalist ("physiologus"), Thetel or Techel, on stones and their magic effects.[8] He does not say, however, from which language the translation was made. Techel is probably identical with Zethel, Zachel or Zael, the author of astrological treatises,[9] and may ultimately stand for Sahl ibn Bishr, a Jewish astrologer of the ninth century.[10] Perhaps, however, "Techellus" never was a concrete person, but merely a name to indicate a doctrine.[11]

There is little to add about the significance of a treatise on the magic effects of carved stones and images for Paracelsus himself or any of his followers. The "Gamaheu," the carved stone, is the universal instrument in which the magician preserves supernatural (sidereal) forces and virtues and through which he transfers them to other objects.[12] In the book *On Images* Paracelsus enlarges on the miraculous pictures found engraved

[7] "nun spricht der meyster disz buchs im Latein das ich zu teutsch pring er wene das dem büchlein (sc. Techel's) auch nit gar sey zu glauben—aber der meister redet als ob die stein ire pild nur von kunst haben und nit von natur. Das ist nit war." Choulant, *op. cit.*, p. 104.

[8] M. Steinschneider, *Die hebraeischen Uebersetzungen des Mittelalters*. Berlin: Kommisionsverlag des Bibliographischen Bureaus, 1893, p. 237, espec. note 922. Lynn Thorndike, *History of Magic and Experimental Science*. New York: Macmillan, 1923-1958, vol. II, 1923, pp. 389-390 and Appendix II on some manuscripts of the treatise of Thetel on Seals. The text of: *Cethel aut veterum Judaeorum physiologorum de lapidibus sententiae* (Thomae Cantipratani *Prooemium de sculpturis lapidum*) is found in: Pitra, J. B., *Specilegium Solesmense*, tom. III, Paris, 1855, pp. 335-337. On the manuscript tradition of the various versions of the name Cethel, *see ibid.*, p. 335, footnote. The versions: "Cheel" and "Theel" appear to be of particular interest with reference to "Techel"—"Techellus." *See also*: Conrad von Megenberg, *Das Buch der Natur*. Bearbeitet von Hugo Schulz. Greifswald, 1897, p. VIII: "Wer der Jüdische Gelehrte Tethel gewesen is, habe ich, trotz vielfachen Suchens und Nachfragens nicht herausbekommen können."

[9] Thorndike, *loc. cit.*, p. 390.

[10] G. Sarton, *op. cit.*, vol. I, 1927, p. 569 and vol. II (2), 1931, p. 593.

[11] For suggestions in this respect see the present author in *Paracelsus. An Introduction to Philosophical Medicine in the Era of the Renaissance*. Basle and New York: Karger, 1958, p. 214, note 43. This must be supplemented by the material contained in the present article.

[12] Paracelsus, *Philosophia sagax*, lib. I, cap. 6, *In probationem artis magicae*, ed. Sudhoff, vol. XII, p. 133.

in rocks, caves, and secret passages, also on those in small stones, pebbles, and "gamahei." Such images seem to be works of art, but in reality have grown naturally through the ordinance of God and convey their own "great prophetic message," which will be understood by "magi and chiromantici." [12]

Here, then, we have a *genuine* treatise in which Paracelsus takes pains to advocate Techellus' point of view. Could it be used as a piece of internal evidence in favour of the authenticity of the *Liber Principiorum*? Not only the latter, but also *De Imaginibus* may have been based on Megenberg and his defence of Techellus. At all events, the doctrinal contents of the former treatise lose little in Paracelsean authenticity by the invocation of Techellus, and the question of the genuineness of the treatise does not seem to lend itself to an easy solution.

POSTSCRIPT: Of authors mentioning Thetel since the XVIth century only two may be cited:—1) Rudolph Goclenius (1572-1621) has in his *Mirabilium Naturae Liber Concordias et Repugnantias Rerum in Plantis, Animalibus, Animaliumque Morbis et Partibus manifestans* (Francof. 1625, p. 258) *Imagines seu sigilla Thetelis.* It begins: "Thetel vetustissimus Doctor tractans de sculpturis lapidum, ait, has sculpturas in convenientibus lapidibus repertas, maximam habere virtutem. Hominis imago sculpta in Iaspide. . . ." This is followed (p. 260-287) by *Sculpturae Salomonis.* 2) Ernst Theodor Amadeus Hoffmann (1776-1822), the deep and witty romantic writer, describes how the "uncouth" and interfering "Genius Thetel" removed the body of the "Blumenkönigin Gamaheh" through the firmament to Samarkand—a journey on which "Meister Floh" clinging to Gamaheh's Brussels lace fell into the focus of Leuwenhöck's "magic instrument" and hence straight on the nose of the observing magician who immediately placed him on a Russwurm Universal Microscope. (Hoffmann, E. T. A., *Meister Floh. Ein Märchen in sieben Abentheuern zweier Freunde.* Frankfurt a. Mayn: Fried. Wilmans, 1822, pp. 57-59; 90-91 and passim).

[12] Paracelsus *De imaginibus*, cap. 7, ed. Sudhoff, vol. XIII, pp. 373-375.

MEDICO-HISTORICAL NEWS AND ACTIVITIES

CORRESPONDENCE AND REPORTS

WU LIEN-TEH (1879-1960)

Although Dr. Wu had devoted his life to combatting illness in his family and in the Far East in general, his autobiography[1] does not tell of any illness of his own. Even in adversity he had obviously adhered to his maxim "Be contented—live long." And yet his attainments eloquently indicate that his contentment was far from non-action. His intelligence, industry, and eagerness to help, on the contrary, had made his life active and important to its very end. His death came less than a year after the publication of his autobiography. Nevertheless, he lived to enjoy the success of his final work. In a letter which he sent me on September 16, 1959, he expressed this pleasure and his hope that "my book will reach as many American friends as possible, for they are so far away in spite of their great philanthropic efforts to bring comfort and happiness to this world."

He was still in good health, obviously, at that time, for in talking about his old friend and co-author he stated: "You will be pleased to learn that my colleague of the *History of Chinese Medicine*, Dr. K. C. Wong, is also still alive in Shanghai though not so active as my humble self. All through life Dr. Wong and myself have been great friends and colleagues, and if recent events had not happened, he and I would still be undertaking joint work and perhaps bringing out a new edition of the History."

Clearly he was not then troubled by premonitions of death. In January of 1960, however, a number of American newspapers carried the following brief notation: "Dr. Wu Lien Teh, 81, former surgeon-general to Chiang Kai-shek and credited with saving millions of persons in China from the bubonic plague in 1910, [died] at Penang, Malaya."

ILZA VEITH

Deaths of Dr. John Fulton and Dr. Charles Singer.

The Bulletin *records with deepest regret the deaths of Dr. John F. Fulton on May 29, 1960, and of Dr. Charles J. Singer on June 10, 1960. Obituaries will be carried in later issues of the* Bulletin.

[1] Reviewed in this *Bulletin*, p. 285.

ANNOUNCEMENTS

AMERICAN ASSOCIATION FOR THE HISTORY OF MEDICINE

THIRTY-FOURTH ANNUAL MEETING: CHICAGO, ILL., MAY 18-20, 1961.

The Thirty-fourth annual meeting of the American Association for the History of Medicine will be held in Chicago, Ill., May 18-20, 1961. Dr. Ilza Veith is chairman of the Committee for Local Arrangements.

Members who wish to present papers are asked to send an abstract of not less than 500 words to the chairman of the Program Committee, Professor Charles D. O'Malley (School of Medicine, University of California, Los Angeles 24, California).

NATIONAL NEWS

International Congress for Logic, Methodology, and Philosophy of Science

An International Congress for Logic, Methodology, and Philosophy of Science will be held at Stanford University, Stanford, Cal., Aug. 24 to Sept. 2, 1960, under the auspices of the International Union for History and Philosophy of Science.

Medical Motion Pictures

The National Library of Medicine arranged a two month exhibit: "Pioneers of the Medical Motion Picture in the United States," closing April 29, 1960.

Temple University School of Medicine, Philadelphia

The second Victor Robinson Lecture in History of Medicine was announced for May 11, 1960, with Richard H. Shryock speaking on, "The Role of History in Medical Education." The presentation of a portrait of Dr. Victor Robinson was scheduled, with remarks by Dean Robert M. Bucher, and Dr. Fred B. Rogers.

NEWS FROM ABROAD

Basel

The University of Basel, founded by Papal bull, November 12, 1459, and inaugurated in ceremonies in the choir of the Minster, April 4, 1460, this year celebrates its 500th anniversary. The *Bulletin* extends greetings and congratulations on this important occasion.

Peru

Dr. Francisco Guerra informs us of the death of Dr. Juan B. Lastres y Quiñones (1902-1960). Dr. Lastres was especially well known for his historical work on medicine in Peru, and reviews of several of his books have appeared in the *Bulletin*.

BOOK REVIEWS

FRITZ STECKERL. *The Fragments of Praxagoras of Cos and His School.* Leiden: Brill, 1958. IX + 132 pp. 12.50 guilders.

The present volume fills another lacuna in our knowledge of those ancient physicians whose writings have suffered the accidents of history. Professor Steckerl has collected in this valuable study the extant remains of Praxagoras and his disciples—Phylotimus, Plistonicus and Xenophon. Following a short chapter on Praxagoras' *vita* (pp. 1-6)—his birth is placed ca. 340 B. C.—there is a detailed account of his medical doctrines (pp. 7-44). The text of the 120 fragments of Praxagoras, plus a total of 39 for his three disciples, then follows, accompanied in each case by an English translation. An *index fontium* concludes the volume.

As a result of this study, Praxagoras' place in the history of medicine must be revised. He was neither a "Nachtreter" of Diocles (Wellmann, *Die Fragmente der sikelischen Aerzte*, p. 11, followed by Baumann, *Janus*, 1937, *41*: 168) nor is he deserving of the praise bestowed upon him by Rufus Ephesius—*ἀνὴρ οὐχ ὁ τυχὼν . . . ἐν τοῖς κατὰ τὴν ἰατρικὴν θεωρήμασιν* (fr. 27[2]; for similar praise cf. frr. 27[3], 43). For, as Steckerl convincingly demonstrates, Praxagoras was no mere *epigonos*: his humoral pathology differs from both Aristotle's and Diocles' theories (p. 36); his insistence on the analysis of foodstuffs is a major step in dietetics (pp. 12 sq.); his anatomical fragments indicate considerable first-hand knowledge which may have been the result of dissections (p. 31), and most important perhaps is his original, albeit erroneous, doctrine of the pulse (p. 22). On the other hand, Rufus' estimate of Praxagoras as "no ordinary practitioner" must not be pressed so far as to suggest that he was an innovator or originator of doctrines which have proved to be of worth in succeeding centuries of medical practice. His conception of the heart as the center of the higher faculties (frr. 30, 62, 69, etc.) was common in antiquity as was much of his pneumatology. "Praxagoras has," states Steckerl, "neither explained any one of the diseases he was dealing with in an acceptable way nor treated them 'reasonably'" (p. 30). The juster estimate, and a summary as remarkable for its brevity as for its perspicuity, is the sentence immediately following—"However, his general reflections were excellent" (*l. c.*).

What were these? It is difficult to be precise because, as in each reconstruction of fragments, it is the historian's ability to account for the evidence in a plausible manner, rather than truth, which is the criterion by which it is to be assessed. So it is with Steckerl's reconstruction—it accounts for the evidence in a masterful fashion. The key to the reconstruction is to be found in Praxagoras' pneumatology and humoralism which ground alike his physiology, normal and abnormal, his therapy, and his dietetics. Thus apoplexy results when phlegm prevents the entrance of pneuma into the aorta (fr. 74), and jaundice is caused by a cooling of the innate heat and the humors (fr. 64). The physiology of the circulatory (frr. 26 sq.) and respiratory (frr. 29 sq.) systems, as well as such therapeutic devices as vapor-baths (frr. 78, 101) and dietetic *praecepta* (frr. 99-100), likewise points to the

same bases. Of especial importance, in this regard, is the role played by bubbles in both normal and pathological conditions. The ultimate cause of epilepsy is the humors which arise during digestion as the result of an imbalance of innate heat (fr. 18 cf. pp. 10-11). The proximate cause, however, is the bubbles which result from an accumulation of phlegmatic humors in the region of the aorta. Because these bubbles prevent the passage of the psychic pneuma from the heart, the body is shaken and convulsed (fr. 70, cf. fr. 71). When the bubbles burst, the disease subsides. Steckerl argues that the bursting of the bubbles also accounts for the pneuma in the arteries (p. 25). The merit of this argument is twofold. It shows Praxagoras to have had a consistent theory (cf. p. 27), and secondly, it makes sense of a theory that, apparently, puzzled even Galen (cf. fr. 28[2]). Moreover, the bubbles account for other pathological conditions, like σπασμός, τρόμος and παλμός (fr. 27), and provide, so Praxagoras thought, a reliable clue to the nature of the arterial system (frr. 84-85), while Phylotimus (fr. 13) proves that Praxagoras' account of the origin of disease in terms of bubbles is but a special case of the normal digestive process.

Finally, a few random remarks. By a careful analysis of 482 b 15 sq. (pp. 24-25), Steckerl defends well a theory proposed by Jaeger (*Hermes* 1913, *48*: 43 sq.) that Pseudo-Aristotle, *De Spiritu* 4, 483 a 17, is an echo of Praxagorean theory. If less convincing, it is nevertheless an attractive theory, that two passages from the *Anonymus Londinensis* (V 35, VI 31 pp. 34, 38, Jones) and Hippocrates, *On Ancient Medicine*, 22, establish the context within which the Praxagorean theories are to be understood and link Praxagoras directly to a Coan, rather than to a Peripatetic or Sicilian tradition as Wellmann and Jaeger believed. It is unfortunate that Steckerl did not include the (Pseudo?) Praxagorean *Epistula* (cf. H. Diels, *Abhandlungen der königl. preuss. Akademie der Wissenschaften*, 1906, p. 86). It is equally unfortunate that Drabkin's text of Caelius Aurelianus was not used more extensively for the text of those fragments preserved by Caelius. It would have saved Steckerl from printing some doubtful Latin (e. g. fr. 103, last sentence) and other passages which may be questioned.[1]—Space does not permit comments on frr. 102, 103, 105, 109, 112, 113 which are disfigured by misspellings, readings with no MSS authority, etc. *Anth. Plan.* 273 might be considered as an additional fragment instead of being accepted only as a *testimonium vitae* (p. 4) on the strength of Rolleston's supposition that vs. 4 refers to malaria (*Proc. Roy. Soc. Med.* (*Hist. Sect.*) 1914, *7*: 37). Generally, only the Greek text received attention from the proof reader; the editor's introduction, Latin text, and translations are filled with misspellings and minor numerical errors.

JERRY STANNARD

[1] (Fr. 63) for κωματώδη (= cωματωδεν Rovill.) read *catochen* Amman, accepted by Steckerl in the next sentence; (fr. 66) *ex interiore* conj. Drabk. : *et interiora* edd. deserves consideration as does (fr. 112) *repugnantem ordinat* conj. Drabk. : *repugnante mordicativo* codd. (cf. *T. A. P. A.* 76 (1945) 316); (fr. 73) *Asclepiadi* codd. is difficult to defend; read *Apollonio* (cf. Drabk. *ad loc.* and *op. cit.* 309); (fr. 112) obelize and read † *moromeli* †.

IMMANUEL JAKOBOVITS. *Jewish Medical Ethics.* A comparative and historical study of the Jewish religious attitude to medicine and its practice. New York: Philosophical Library, 1959, xlii + 381 pp. $6.00.

In the subtitle of this book and in the Preface, Rabbi Jakobovits makes the following clear statement of his objective: the book is "a comparative and historical study of the Jewish religious attitude to medicine and its practice." "The following chapters, while they may serve as a guide to the sources and principles governing the religious attitude to medico-moral problems, constitute a mainly historical study. As such, the decisions featured in it cannot be used as practical directives, whether by doctors, patients or theologians, except when endorsed by qualified scholars in each individual case. No religious rulings on medical procedures of any kind should therefore be made simply on the basis of this work. Our principal object has been, rather, to provide an introduction to the considerations involved, and to survey the development of the views and teachings in an area where the three most vital disciplines of human life—religion, law and medicine—meet and often overlap" (pp. viii-ix). The twenty chapters cover quite an array of topics dealt with at various length, at times rather sketchily, beginning with the attitude to medicine and some irrational medical beliefs, down to such timely subjects as contraception, euthanasia, and artificial insemination.

Although he refers to his study, originally presented to the University of London as a thesis for the Doctorate of Philosophy in 1955, as "a modest attempt," the book has impressed the reviewer with the erudition and thoroughness of the author and with the dispassionate and objective presentation of the entire material, both Jewish and non-Jewish. The copious instructive notes and bibliography, constituting practically a third of the book (pp. 251-381), enrich the material for selective reading. But this commendable section would be even more useful if it had an index of subjects and authors rather than the bibliography in its general form (pp. 362-381). Thus, for example, it is doubtful whether the author had to avail himself of all the 24 volumes of the Encyclopaedia Britannica. The referral to the Oxford English Dictionary, unless specifically indicated, is hardly called for; and surely once this 12-volume work has been used, the Concise Oxford Dictionary seems superfluous! Furthermore, if the McGill Medical Journal has been used, which volume, which number, and which page, or pages?

Well presented is the portion on the "attitude to flight from plagues" in the first chapter (pp. 10-15). The cited Montreal outbreak of smallpox in 1885 illustrates the all too well known price humanity pays for narrowmindedness and dogmatism. Further, on p. 19, the author says that "the belief in the curative powers of religious shrines and saintly relics is unknown among the Jews." And whilst the "epidemic of superstition" "affected predominantly the Jewish communities . . . where the general level of enlightenment was very low . . .", the Jews in other parts of Europe were practically immune to it(Ch. II, pp. 29-30). This ethnic differentiation, however, must not mislead the reader to overlook the fact that superstition has always been a universal characteristic of the ignorant masses anywhere, and that Jewish believers in charms, amulets, cryptograms and various permutations and combinations of letters, and changing of names as cure of illness, or protection against evil, or "Song-of-Degrees" amulets suspended on

the walls of delivery rooms against Lilith, or exorcisms, have been prevalent until this century. While on the subject of "folk medicine," it is surprising that the author has not drawn at all on sources in Yiddish literature which is at least five to six centuries old!

Chapter 2, on "Irrational medical beliefs," and chapters 16, 17, and 18, on "The physician," had been previously published in the Hebrew Medical Journal (N.Y.), *Harofeh Haivri*.

An interesting, albeit brief, presentation is also the section on euthanasia (Ch. 11, pp. 123-125). To this reviewer the differentiation between "active" and "passive" euthanasia, "moderate form" of euthanasia and, therefore, the implied though not thus specified extreme form of euthanasia, is, as a matter of moral principle, amusing, were it not objectionable.

Chapter 12, "The dead and their treatment," which includes the topic of anatomical dissection, is interesting and important, but its material does not seem to differentiate clearly and sufficiently between dissection for anatomical study preparatory to the pursuit of medical practice, and necropsy for clinico-pathological correlative study.

Confraternal medical ethics, has almost always been forgotten by both medical and lay writer and reader. Surely some fundamental, as well as less important, precepts of behaviour have been enunciated to guide the physician in his relationship to his colleague and confrere. What of the "attitude" on this subject to be found in the writings, for example, of Hippocrates and Galen, down to Isaac Israeli and Maimonides (-Herz)? No mention of that is made in the present book.

Finally, here are a few more instances of dissenting observation: On p. 228, line 26, "opprobium" should be "opprobrium"; on p. 234, line 22, "affets" should be "affects"; on p. 248, line 7, "chonicle" should be "chronicle"; on p. 277, line 33, "Aramic" should be "Aramaic"; and on p. 381, line 19, "MacGill" should be "McGill."

M. Etziony

M. D. Grmek. *On Ageing and Old Age*, Basic Problems and Historic Aspects of Gerontology and Geriatrics. (*Monographiae Biologicae*, 1958, Vol. V, No. 2). Den Haag: Uitgeverij Dr. W. Junk, 1958. 106 pp. Ill. 14 guilders.

This important little book appears at the best possible time. One of the most remarkable medical developments since World War II has been the enormous growth of interest in the care of the aged. Geriatrics has become a well-organized specialty, and gerontology, comprising the biology, psychology, and sociology of aging, is receiving major attention from the foundations, the government, and the public. The scientists and physicians working in these newly-recognized fields have felt a need for historical orientation; the Gerontological Society, for example, voted at its 1958-59 meeting to establish a committee on history. At the same time, historians have been taking more and more notice of the shift in medical emphasis from the problems of early and middle life to those of later years.

Actually, this is the second monograph-length history of geriatrics and geron-

tology. The first such study was by Frederic D. Zeman and was entitled *Life's Later Years: Studies in the Medical History of Old Age*. It was published as a series of 13 articles in the *Journal of the Mt. Sinai Hospital* (N. Y.) between 1942 and 1950. Dr. Zeman's work proceeded in a methodical manner through the chief periods of history from primitive societies to the end of the nineteenth century. Unfortunately, it has not as yet been issued in book form, but those able to consult the articles will find that the chronologic approach, the leisurely pace, and the numerous illustrations make them a pleasing introduction to the field.

Dr. Grmek's study, in contrast with Dr. Zeman's, is concise to an extraordinary degree and is more varied in format. In the 88 data-packed pages of the text proper there are eleven different chapters, all historical in nature but not consistently chronological: 1. Definitions, 2. Causes and Nature of Ageing, 3. Phases and Symptoms of Ageing, 4. Longevity, 5. Rejuvenation, 6. Geriatrics in Antiquity and the Middle Ages, 7. From the Renaissance to the end of the 18th Century, 8. Geriatrics in the 19th Century, 9. Remarks on the History of Arteriosclerosis, 10. Old Age as a Psychological and Social Problem, 11. The Modern (20th-Century) Geriatric Movement. Several chapters are only four or five pages long, but the work is weightier than size alone would indicate. Had it been written in a less laconic style, it easily might have been two or three times as long.

The most valuable feature of the book is Dr. Grmek's impressive grasp of a vast range of source material, both primary and secondary. The text is backed up with some fourteen pages of excellent footnotes which cite hundreds of separate works. Undoubtedly, this collection of footnotes represents the finest bibliography ever assembled on the history of geriatrics and gerontology, and it testifies to the author's previous experience with historical research. Working in Zagreb, Mirko Dražen Grmek has written in Croatian many studies of medical history, most notably a biography of Santorio Santorio and, as editor, a volume on the history of Croatian medicine. Of course, while praising the acumen of the author, one must not forget that the monumental bibliographies of N. W. Shock and the pioneering historical investigations of F. D. Zeman, J. Steudel, J. T. Freeman, S. R. Burstein, and many others helped to prepare the way for a work of this type.

Especially original and useful are the references to events in the medical history of Eastern Europe. The author's acquaintance with Yugoslav, Czech, Rumanian, and Russian material helps to map in a *terra incognita* of previous research in this field. At the same time, he shows a thorough conversance with West European and American sources. However, as in nearly all works of medical history, the discussion of Arabic, Far Eastern, and Medieval Latin medicine is based on inadequate data.

Although most of the material is so outstandingly good, the presentation of it falls short in certain respects. The text is so condensed and, in places, so abruptly didactic that it makes for slow and difficult reading. At the same time, the organization of the first five chapters on topical rather than chronological lines gives an impression of repetitiousness. The printing of names in capital letters, which might have been very serviceable, becomes self-defeating when applied in such a mechanical manner that, in a single paragraph, the name of Charcot appears in capitals seven different times. Finally, the usefulness of the footnote section as a bibliography is limited by the failure of the author to arrange it in a way that would have allowed easy access, either chronological or alphabetical.

The quality of the interpretation varies a good bit; at times the author is penetrating and creative, but then again he adopts a superficial tone and allows the data to escape from control. By and large, this is a study to be admired more for its wide-ranging scope than for its depth of analysis. The best-organized chapters are the one on the causes of aging and the one on geriatrics in the nineteenth century. Incidentally, for those who might be concerned that a doctrinaire quality might appear in this work from contemporary Yugoslavia, it may be said that the author has no ideological axe to grind; he discusses a great variety of concepts and hypotheses in an objective and impartial manner.

This is the first separately-published history of geriatrics and gerontology, and, despite some failings in editing and analysis, the author has succeeded in bringing together an invaluable collection of material on these subjects. The editors of the *Monographiae Biologicae* deserve commendation for issuing this much-needed study, and at a relatively modest price (about $3.78). The book, of course, is indispensable to anyone directly concerned with the problems of the aged. But it is more than a work for the specialist alone. Dr. Grmek has approached his subject from an unusually comprehensive point of view, and those concerned with the general history of medicine will find here much that is interesting and illuminating.

GERALD J. GRUMAN

WU LIEN-TEH. *Plague Fighter*, the Autobiography of a Modern Chinese Physician. Cambridge: W. Heffer & Sons, Ltd., 1959. x + 667 pp., Ill. 30s.

This superbly interesting autobiography contains a wealth of information far beyond the successful fight against the plague in Manchuria which is the author's most important personal achievement in the long years of his unusually active and successful medical life. The book opens with a lengthy account of the successive waves of pneumonic plague, the first of which in the winter of 1910-11 almost equalled the Black Death in ferocity, claiming 60,000 victims within a few months and extending over the enormous territory from Northern Manchuria to Peking.

When Dr. Lien-Teh Wu was appointed as head of the Manchurian Plague Prevention Service, the epidemic had been raging for almost a month and, among other devastations, had caused a major diplomatic crisis. Northern Manchuria, where the epidemic began, numbered among its inhabitants a great many Russians and Japanese, and their respective governments had expressed their intention to send their own health officers, thus threatening to ignore Imperial Sovereignty, unless China adopted stringent measures to control the disease. The plague, therefore, became a concern of the Ministry of Foreign Affairs, and this agency hastened to assign the vital mission to Dr. Wu whose European training and knowledge of bacteriology were promising qualifications. In action, he more than fulfilled the Ministry's expectations. Through his brilliant leadership and the unreserved support of the Imperial Government, which sanctioned such thoroughly un-Chinese measures as mass cremation and immediate burial, the epidemic was crushed in less than four months. As a result, Dr. Wu's fame assumed such wide

recognition that he was made president of the International Plague Prevention Conference which met in Mukden in the Spring of 1911.

The later epidemics of 1917-18 (Shansi) and 1920-21 (Manchuria), while still severe, never attained the medieval proportions of the first and were soon brought under control by the measures which had been evolved during the first onslaught. The author's personal fearlessness, his resourcefulness, and his skill in handling his less emancipated fellow-Chinese and his non-Chinese colleagues whose initial hostility "he smiled away," emerge impressively in this factual account.

Although then only thirty years of age, Dr. Wu's scientific and social preparation left almost nothing to be desired for this challenging task, except for his self-confessed lack of command of the Chinese language which he thoroughly corrected later on. Born in 1879 of Chinese parents in Penang on the Malay Peninsula, Dr. Wu received his early education in English schools and then proceeded in 1896, on a Queen's Scholarship, to Cambridge where he spent eight successful years and obtained four degrees before receiving his eventual M. D. He was also granted many additional fellowships and scholarships which enabled him to pursue further studies at the Hygienisches Institut at Halle, Germany, and at the Pasteur Institute in Paris. During his European sojourn he relished deeply the awareness of being part of the living history of a burgeoning era in science, along with the leaders of the movement who were his teachers. Among these in England were such figures as Sir Michael Foster, Sir Charles S. Sherrington, Sir Thomas Clifford Allbutt, and Sir Henry Dale. In France his studies were guided by Elie Metchnikoff.

Equally interesting with his narrative of the development of his scientific career are Dr. Wu's beguiling descriptions of the new world in which he found himself. And actually, as an "overseas" Chinese, all but Penang was new to him and was avidly discovered. The reader shares his experiences in England and the European Continent which he details minutely, his rediscovery of Malaya when he returned in 1903, and his mature efforts to understand China where he settled in 1908 to become Vice-Director of the Army Medical Hospital in Tientsin and subsequently leader in the fight against the plague. Of particular interest also are his later impressions of the United States where he studied on still another fellowship at the Johns Hopkins School of Public Health.

In the nearly 700 pages of his book the author encompasses all conceivable phases of the world around him from the amusing observations of the minutiae of everyday life to the contemplation of the historical, cultural, and social forces that had shaped the peoples among whom he found himself. His reflections on the history of China and its medicine are objective though deeply sensitive and become all the more vivid because they are presented through the pen of one who, as an adult, discovers his own ancestral background.

It is remarkable that a life of close family attachments and numerous warm friendships, of such extensive cultural studies and major accomplishments, should have room for still further achievements in other fields of science. And yet, to the medical historian he has long been known as co-author with Dr. K. C. Wong of their invaluable *History of Chinese Medicine*. Beyond this, he engaged in the study of cholera and other infectious diseases, works in the fields of hygiene and public health, the narcotics problem, medical education, and finally the manage-

ment of quarantine hospitals. All these endeavors are documented by his many publications.

The autobiography was written over the course of several years and is obviously based on diary notes, for even minds with total recall would hardly be able to remember the many persons and names encountered during an 80 year life-span, to say nothing of the details of expenditures and menus in foreign lands. These extraneous details and the occasional repetitions only serve to heighten the pleasure of reading this book, the twenty-fourth and final chapter of which, written in the author's 79th year, carries the sage title: "Be Contented—Live Long."

ILZA VEITH

ROBERT W. MCCLUGGAGE. *A History of the American Dental Association.* A century of health service. Chicago: American Dental Association, 1959. 520 pp. Ill. $8.00.

The lineage and achievements of the American Dental Association constitute landmarks of which every member of our profession has justifiable reason to be proud.

The story of the evolution of dentistry is always intriguing because of a constant awareness of the tremendous difficulties which confronted the pioneers and how these were surmounted.

When *The American Journal of Dental Science* began publication in 1839, charlatanism was rife; anyone possessing a key instrument and a few scrapers considered himself competent to treat dental disorders. Besides, there was a lack of coöperation among even reputable practitioners, and the 'amalgam war' was in progress.

In 1840, the American Society of Dental Surgeons was founded and the Baltimore College of Dental Surgery opened. The latter was due to the persistent efforts of Eleazar Parmly, Horace H. Hayden, and Chapin A. Harris who became the first Dean.

The full impact of these notable achievements was not, by any means, confined to America.

Although Chapin Harris had, in 1843, envisaged a network of constituent state organizations, it was not until 1855 (mainly through the efforts of Elisha Townsend) that this became a reality as the American Dental Convention. Although totally inadequate for the requirements of an educated, enlightened body of practitioners scattered throughout the American Continent, it resulted in the inauguration, in 1859, of the American Dental Association, with twenty-six founder members including such renowned persons as W. W. Allport, Isaiah Forbes, H. J. McKellops, J. H. McQuillen, and Jonathan Taft.

The outbreak of the Civil War, with the secession of the states of the Deep South, had a temporary adverse effect on the Association. Consequently, plans for the 1861 meeting were abandoned, but resumed in the following year when the attendance was only twelve delegates and three permanent members.

It was a momentous forward step when the Association decided, in 1864, to include clinics at its annual meeting.

The curricula of the dental colleges were a subject of paramount importance to the Association which eventually made its influence felt, because no doubt of the democratic manner in which its affairs were conducted.

Today, the American Dental Association has nearly 100,000 members: and Harold Hillenbrand, the Secretary, administers a staff of 165.

Besides possessing its own Journal, it sponsors the *Journal of Oral Surgery, Anesthesia and Hospital Dental Service*: *Dental Abstracts*: *Accepted Dental Remedies*: and the *Index to Dental Literature*.

Other ramifications include: Bureau of Standards (founded 1901), Council on Dental Therapeutics (1930), Relief Fund (since 1948 a separate corporation), Life Insurance (1929, since 1952 covering health and accident).

After having detailed further problems and activities of the Association in the light of social and economic progress, Dr. McCluggage (the true historian) contents himself by stating: Whether the solutions will prove equal to the issues they face awaits the verdict of history.

This carefully written, scholarly work—a mine of information on dental history—is attractively presented and ably documented with a comprehensive index. It reflects the greatest credit on all concerned in its production. The aims outlined in the Foreword by Dr. Lon Morrey (who directed the project) have been achieved in an outstandingly successful manner, particularly ensuring that this history is both interesting and arresting and not merely a recital of naked facts.

No enlightened dentist anywhere can neglect to have this volume on his shelves *after* reading it. There is also much of value to medical historians, as Professor Shryock stresses in his Introduction.

By turning back the pages of history, we gain inspiration for the future from those responsible for dentistry being now accepted as a great profession.

J. MENZIES CAMPBELL

Directory of the Medical Library Association. Foreword by JOHN F. FULTON. Second edition. Hamden, Conn.: The Shoe String Press, Inc., 1959. xxxi + 274 pp. $7.00.

The first edition of this *Directory* appeared in 1950. Now, under the chairmanship of Mrs. Henrietta T. Perkins, the Directory Committee of the Medical Library Association has brought out a second edition. The membership is given in two sections. Institutional members are arranged geographically, by state or country, and then by city. Each entry provides statistical information about the institution—date of founding, size of collection, budget, staff, etc. The individual membership is listed alphabetically. There is an index of libraries and special collections, and, in addition, the volume contains the Certificate of Incorporation of the Association, its Charter, and its By-Laws revised to June 19, 1959.

JANET B. KOUDELKA

THE BULLETIN RECENTLY RECEIVED*

Acta Medicae Historiae Patavina. Vol. IV, Anno accademico 1957-58. Padova: Istituto di Storia della Medicina dell' Università di Padova, 1959, vi + 153 pp. Ill.

Acta Medicae Historiae Patavina. Vol. V, Anno accademico 1958-59. Padova: Istituto di Storia della Medicina dell' Università di Padova, 1960, vi + 125 pp. Ill.

José F. Prieto Aguirre. *La obra de Boix y Moliner*, Historia de una polémica. Salamanca, 1960, 52 pp. Ill. (Estudios de Historia de la Medicina Española, Universidad de Salamanca, nueva serie, Tomo I, Núm. 6.)

P. A. Dalal. "The Last Epidemic of Plague in Bombay." Reprinted from *The Indian Practitioner*, 1959, pp. 791-794, 841-846, 927-934, 991-995.

Loyal Davis. *Fellowship of Surgeons*: A History of the American College of Surgeons. Springfield, Ill.: Charles C. Thomas, 1960, vi + 523 pp. $10.50.

Walter Erwin. *Poems on Pertinent Topics.* New York: Pageant Press, Inc., 1959, 117 pp. $2.75.

Luis S. Granjel. *La obra de Gaspar Bravo de Sobremonte.* Salamanca, 1960, 24 pp. Ill. (Estudios de Historia de la Medicina Española, Universidad de Salamanca, nueva serie, Tomo I, Núm. 5.)

William LeFanu. *A Catalogue of the Portraits and Other Paintings Drawings and Sculpture in the Royal College of Surgeons of England.* Edinburgh and London: E. & S. Livingstone, Ltd., 1960, xii + 119 pp. Ill. $6.75. (The Williams & Wilkins Co., Baltimore, exclusive U. S. agents.)

Susanna Lundsgaard-Hansen-von Fisher. *Verzeichnis der gedruckten Schriften Albrecht von Hallers.* Bern: Paul Haupt, 1959, 87 pp. (Berner Beiträge zur Geschichte der Medizin und der Naturwissenschaften, Nr. 18.)

A. Palla and T. Trencséni (Editors). *Az Orvosi Hetilap Centenáriumi Emlékkönyve.* Budapest, 1959, 175 pp. Ill. (Commemoration issue of the centenary of the Hungarian weekly, *Orvosi Hetilap*, founded in 1857.)

J. J. Pindborg and L. Marvitz. *The Dentist in Art.* Chicago: Quadrangle Books, 1960, 144 pp. Ill. $12.50.

Loris Premuda. *Storia della medicina.* Padua: CEDAM, 1960, 277 pp. (Collana di guide per esami universitari, 17.)

Henry E. Sigerist on the Sociology of Medicine. Edited by Milton I. Roemer. New York: MD Publications, Inc., 1960, xiii + 397 pp. $6.75.

* The *Bulletin* reserves freedom of decision as to the publications to be listed in this section. Items received, other than those assigned for review, are ultimately incorporated into the collection of the Institute of the History of Medicine.

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CELLULAR PATHOLOGY AND THE DEVELOPMENT OF THE DEFICIENCY DISEASE CONCEPT *

RICHARD H. FOLLIS, JR.

I

A number of clinical and pathological entities are grouped today into one category: deficiency disease.[1] Even though some of these diseases, such as scurvy and rickets, have been recognized for centuries, that they are due to a lack of something was not recognized for some time. The story of the development of our knowledge of deficiency diseases has often been told, particularly from the nutritional and biochemical standpoints.[2, 3] Little attention has been given to the contributions, if any, of those who were interested in the pathogenesis of disease, i. e., pathologists. Since 1958 marked the end of a century of cellular pathology, for Rudolf Virchow's *Die Cellularpathologie* was published in 1858,[4] it has seemed appro-

* Based in part on lectures delivered at the Armed Forces Institute of Pathology, Washington, D. C. on December 3, 1958 to observe the centennial of Rudolf Virchow's *Die Cellularpathologie* and at a meeting of the Johns Hopkins Medical History Club on September 28, 1959.

[1] R. H. Follis, Jr.: *Deficiency Disease.* Springfield: Charles C Thomas, 1958.

[2] Medical Research Council: *Vitamins. A Survey of Present Knowledge.* London: His Majesty's Stationery Office, 1932.

[3] E. V. McCollum: *A History of Nutrition.* Boston: Houghton Mifflin Co., 1957.

[4] R. Virchow: *Die Cellularpathologie in ihrer Begründung auf physiologische und pathologische Gewebelehre.* Berlin: A. Hirschwald, 1858. Trans. from 2nd ed. of original

priate to survey the development of the concept that disease can result from a lack of something in terms of the contributions of students of disease, particularly Virchow himself. Such is the purpose of this discussion, which can be divided into three parts: (1) what information Virchow had to draw upon when he began to work in 1843, (2) what he knew or had added by 1858, and (3) what we have learned in the course of the century since the publication of *Cellular Pathology* and how his great induction influenced these later developments.

To begin with, what sort of information concerning the chemistry of the organism and, in particular, its nutrition did Virchow have to draw upon when he began his researches in 1843? To cite all of the sources available to him is not necessary. We need only mention two standard treatises with which we know he was familiar. The first is the *Handbuch der Physiologie des Menschen*[5] first published in 1834 by his teacher Johannes Müller, Professor of Anatomy and Physiology in Berlin. Of this work Virchow commented, " there are two qualities in his *Handbook of Physiology* which have particularly enhanced my estimation of its value —its strictly philosophical method, and its completeness in facts." [6] Müller's treatise provides us with a complete inventory of what was known concerning the composition of the body, as well as the various types of nutritive substances derived from plants and animals. The elementary substances which had been found in man and the higher species at that time were: oxygen, hydrogen, carbon, nitrogen, sulfur, phosphorus, chlorine, fluorine, potassium, sodium, calcium, magnesium, manganese, silicon, and iron.[7] Several elements: cobalt, zinc, copper, and iodine which are recognized as indispensable today are missing from this list; moreover, a number of ubiquitous elements are not included.[8] Müller's *Handbuch* also mentions certain more complex organic compounds; for instance, he uses the term, ternary compound, for substances such as vegetable mucus, starch, and adipose matter, which contain oxygen, carbon, and hydrogen; while quaternary compounds, such as gum, albumin, fibrin, animal mucus, and resin, are those which contain nitrogen in addition.

as *Cellular Pathology as Based on Physiological and Pathological Histology*, by Frank Chance. London: J. Churchill, 1860. Pages in following references refer to this edition.

[5] J. Müller: *Handbuch der Physiologie des Menschen für Vorlesungen.* Coblenz: J. Holscher, vol. 1, 1834; vol. 2, 1840.

[6] R. Virchow: *Johannes Müller. Eine Gedächtnissrede gehalten bei der Todtenfeier am 24. Juli 1858 in der Aula der Universität zu Berlin.* Berlin: A. Hirschwald, 1858.

[7] Müller: *op. cit.*, vol. 1, p. 1.

[8] Follis, *op. cit.*, pp. 19-21.

The food of animals consists of animal and vegetable substances. Man uses a mixed diet, which Müller lists as follows:[9]

I. Substances derived from the vegetable kingdom:

(1) The acid juices of many plants and fruits.

(2) Starch (amylum)—in the seeds of the grasses and leguminous plants, in the tubers of the potato, in sago, and in *lichen islandicus*.

(3) Vegetable mucilage—in roots and seeds, and in the form of the different gums. It differs from animal mucus in being soluble in water.

(4) Sugar—in the juices of many plants and of their fruits.

(5) Fatty, or fixed vegetable oils—in seeds and some tuberous roots.

(6) Vegetable albumin—in the milky juices of vegetables, in the milk of the milk tree, *brosimum galactodendron*, in seeds which yield emulsions by trituration.

(7) Gluten—generally combined with albumin with the different kinds of grain and other seeds, also in sweet fruits.

(8) Fungin—in the fungi.

II. Principles derived from the animal kingdom:

(1) Gelatin—in the tendons, bones, cartilages, the skin, the cellular tissue, and especially in very young animals.

(2) Albumin—principally in the ova, brain, and nerves, in the blood, etc.

(3) Fibrin—in muscular substance and in the blood.

(4) Animal oil and fat.

(5) Casein— in milk, with animal fat (butter), and in cheese.

Müller wrote that "the proximate elements of the tissue exist in part ready formed in the blood."[10] However, he made sure to say "the opinion that already all the component elements of the organs exist previously in the blood in their perfect state, cannot possibly be adopted: the components of most tissues in fact present, beside many modifications of fibrin, albumin, fat, osmazone, other perfectly peculiar matters, such as the gelatin of the bones, tendons and cartilages, nothing analogous to which is contained in the blood."[11]

Müller called attention to the importance of nitrogen as a nutrient and

[9] Müller, *op. cit.*, vol. 1, p. 459.
[10] *Ibid.*, p. 344. [11] *Ibid.*

noted that "very valuable experiments have been instituted by M. Magendie to determine the nutritive property possessed by substances which contain no nitrogen, by a food, for example, consisting wholly of sugar and distilled water." [13] If Virchow had gone back to Magendie's original paper, published in 1816,[15] he would have found the following:

> With this intention I placed a small dog about 3 years old, fat and in good health, upon a diet exclusively of pure refined sugar with distilled water for drink; he had both *ad libitum*.
>
> For the first 7 or 8 days he appeared to be very well; on this regime he was lively, he ate with avidity and drank as usual. He began to grow thin during the second week, although his appetite was good and he ate 6 or 8 ounces of the sugar in 24 hours. His intestinal excretions were neither frequent nor copious, and the urine was plentiful enough.
>
> Emaciation increased during the third week; strength diminished; the animal lost its spirit; the appetite was not as keen. At this same time, there developed first upon one eye and then upon the other a small ulceration in the center of the transparent cornea; it increased rapidly, and, at the end of several days it was about a line in diameter, its depth increasing in the same ratio; soon the cornea became perforated and the humors of the eye discharged. This singular phenomenon was accompanied by an abundant secretion of the glands of the eyelids.
>
> In the meantime emaciation increased continuously; strength diminished; and although the animal ate 3 or 4 ounces of sugar each day its weakness became so it could neither chew nor swallow; all other movement was impossible. It expired on the thirty-second day of the experiment. I opened its body with every possible precaution; I discovered a total absence of fat; the muscles were reduced to less than five sixths of their ordinary volume; the stomach and intestines were much diminished in size, and strongly contracted.

Magendie went on to study the effects of feeding other single foodstuffs and demonstrated the importance of nitrogen-containing materials. The report just quoted may represent the first experimental production of a deficiency disease, i. e., keratomalacia, the significance of which appears not to have been realized by anyone until many years later.

A second work with which Virchow was familiar was Franz Simon's treatise on pathological chemistry.[14] Simon had been chemist to the Charité when Virchow had worked there as a student. His monograph is one of the first of many which dealt with the pathological chemistry of animal fluids, solids, and gases. For instance, here are found data on

[13] *Ibid.*, p. 461.

[15] F. Magendie: *Mémoire sur les propriétés nutritives des substances qui ne contiennent pas d'azote.* Paris: Méquignon-Marvis, 1816.

[14] J. F. Simon: *Physiologische und pathologische Anthropochemie mit Berücksichtigung der eigentlichen Zoochemie.* Berlin: A. Förstner, 1842.

the hematin content of normal blood and that from cases of chlorosis; the effects of iron therapy in this disease are also cited. Moreover, data on the chemical composition of normal cartilage and bone are included; with these data the abnormal inorganic relationships which are found in these tissues from cases of rickets in children and osteomalacia in adults can be compared.

In summary, during the years preceding Virchow's entry into research, the chemical composition of the body in health and disease was rapidly being elucidated. The basic qualities of foodstuffs were also becoming understood; not long after the appearance of Müller's *Handbuch*, four types of food: minerals, protein, carbohydrate, and fat, were delineated.[15] Magendie's experiments were there for everyone to read. It seems extraordinary that so little attention was paid to them.

II

Virchow was familiar with a number of deficiency diseases which occur naturally in the human. He wrote about starvation, goiter, chlorosis, fatty liver disease, pellagra, rickets, and scurvy. Before discussing each of these it is necessary to point out that Virchow uses the term "nutrition" throughout his works; he devotes a number of chapters of his *Cellular Pathology* to "nutrition," particularly emphasizing the circulatory aspects. As a result of his studies on thrombosis and embolism he was familiar with the effects of interfering with the blood supply of a particular region.[16] His understanding of the actual interchange of nutrients within the tissues was somewhat unclear, though, in speaking of "nutritive irritability," he calls this

> that power possessed by individual parts of taking up, when excited by definite stimuli, more or less matter and transforming it. . . . A part, which nourishes itself, can in doing so either limit itself to a mere maintenance of its existence, or it may, as is especially seen in pathological cases, take up into itself a larger quantity of nutritive material than is wont to happen in the ordinary course of things.[17]

Starvation: Virchow had seen the effects of famine and the relation of undernutrition to disease, particularly typhus, at first hand. His obser-

[15] J. Pereira: *A Treatise on Food and Diet, with Observations on the Dietetical Regimen Suited for Disordered States of the Digestive Organs; and an Account of the Dietaries of Some of the Principal Metropolitan and Other Establishments for Paupers, Lunatics, Criminals, Children, the Sick, etc.* London: Longman, 1843.

[16] R. Virchow: *Gesammelte Abhandlungen zur wissenschaftlichen Medicin.* Frankfurt a. M.: Meidinger Sohn & Comp., 1856, pp. 468-635.

[17] Virchow: *op. cit.* (ft. 4), pp. 333-334.

vations [18] of the terrible conditions in Upper Silesia during the winter of 1848 led after his return to Berlin to his participation in the revolutionary activities of that year. In 1852, he published an account [19] of the famine in the Spessart, a region near Würzburg, where he was professor of pathology at the time. He also published an historical investigation into the great famines of the years 1770 to 1772 in Prussia.[20] The trips to Upper Silesia and the Spessart brought him into intimate contact with "the two most terrible scourges of mankind, famine and disease." [21]

The famine of 1846-48 in Upper Silesia was due to failure of the potato crop. With his usual thoroughness Virchow has traced the story of the introduction of the potato from South America to Spain and England in the sixteenth century. Later, potatoes became the dietary staple in certain regions, particularly Ireland and districts in central Europe. Virchow has a truly modern conception of the bad features of this, for he says,

> In less than a century this vegetable has mightily affected not only agriculture but the whole social life in Europe. Its comparatively great productiveness renders it possible to maintain a far denser population on a certain area of ground than could be done by the cultivation of grain alone. The potato has become, so to say, the corner-stone of the existence of the "small man" in rural districts. Even the workmen and artisans of small towns find in it a comparatively abundant source of nourishment. For a long time therefore, the introduction of the potato appeared to be only a benefit, nay the probability was canvassed of never more knowing what famine was.
>
> The reverse side of this innovation has proved all the more disastrous. We have long been aware that the potato but very insufficiently supplies the body with all the aliment required for its growth and maintenance. Excellent as it is taken along with a due proportion of animal food or fatty matter, its value as a main aliment is doubtful, especially for a labouring population who are restricted to the potato and its product—alcohol. It is not enough that such a people's muscular power gradually diminishes, that they become weakened in constitution, and thereby contract an increased disposition to disease but—*a single failure of the potato crop, or at most a second, places such a people on the threshold of starvation.*[22]

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[18] R. Virchow: Mittheilungen über die in Oberschlesien herrschende Typhus-Epidemie. *Virchows Arch. f. path. Anat.*, 1849, *2*: 143-322.

[19] R. Virchow: Die Noth im Spessart. *Verhandl. d. phys.-med. Gesellsch. in Würzburg*, 1852, *3*: 105-160.

[20] R. Virchow: Die Hungerepidemie von 1771-72 in Unterfranken. *Verhandl. d. phys.-med. Gesellsch. in Würzburg*, 1852, *3*: 161-163.

[21] R. Virchow: *Ueber den Hungertyphus und einige verwandte Krankheitsformen.* Vortrag, gehalten am 9. Februar 1868 zum Besten der Typhuskranken in Ostpreussen Berlin: A. Hirschwald, 1868, p. 1.

[22] Virchow: *op. cit.*, pp. 33-34.

Virchow graphically described the conditions he found in the Spessart.

> The failure of the potatoes was so complete, that in many places it was not considered worth the while to lift them, and the continuous rains rendered it impossible for many to bring in the grain which moreover was barely ripe. Hail had already damaged a part, and the autumnal rains destroyed even the hay, the only thing they had to fall back on for the maintenance of their already reduced number of cattle. The pigs, the main resources of the Spessarter and his chief source of income, had to be sold early, as the potato harvest did not even promise sustenance for man. . . .
>
> The scarcity had reduced the means of nourishment, at all times sparse and one-sided, to the very simplest forms. Butcher's meat, at no time a general fare, was at an end for most people; butter was almost non-existent, milk very rare. Only a few could still bake bread from their own stores, for even the buckwheat was used up . . . Some had nothing but flour of which they prepared soups devoid of both strength and flavour. Others still had peas, lentils, or beans, the best fare under such circumstances, but they had been cultivated so sparingly that they formed an exception rather than otherwise. Many used dried and roasted barley or minced up dried turnips to prepare a decoction which was drunk as coffee, the grounds later being eaten as a meal. . . . Luckily the potatoes which had been lifted when diseased did not spoil further in the cellar . . . But in some places they were only half grown, extremely small, and not very mealy; many searched the fields painfully for roots missed in the fall or left there on purpose. Comparatively abundant and therefore much used was cabbage (sauerkraut), and then turnips.[23]

Despite this sad state of affairs scurvy was not seen among the Spessarters, yet Virchow describes a peculiar condition of exhaustion, weakness, heaviness, and torpidity of the brain mostly devoid of all feverish activity. This he termed "status famelicus" (famine-state), and it is certainly reminiscent of the experimental studies of malnourished persons and of the inmates of concentration camps.[24]

Goiter: Virchow had written about goiter and cretinism while in Würzburg:[25] a number of pages in the third volume of *Die krankhaften Geschwülste* were devoted to *Strumen*.[26] He described and illustrated many of the histological features of goiter, but fully understood the fundamental nature of all of the alterations which may be observed, for he says:

> In reference to true goiter the opinion has long been held that it comprises a series of definite varieties (struma lymphatica, cystica, ossea, et cetera,) which

[23] Virchow: *loc. cit.* (ft. 19), p. 125.

[24] A. Keys, H. L. Taylor, O. Mickelsen, J. Brozek, and A. Henschel: *The Biology of Human Starvation.* Minneapolis: Univ. Minnesota Press, 1949.

[25] Virchow: *op. cit.* (ft. 16), pp. 891-1014.

[26] R. Virchow: *Die krankhaften Geschwülste.* Berlin: A. Hirschwald, vol. III, 1867, pp. 1-84.

can develop independently of each other. This is an error. All of these so-called varieties are only different modes of development of essentially identical formations; they represent for the most part different forms of end stages, of metamorphoses, which can be combined with one another in the same tumor, for which reason sometimes very large and striking varieties of composition occur.[27]

Today the relationship of iodine deficiency to goiter is well-recognized. Hence, it is of interest to determine what views, if any, Virchow had on iodine and struma. For the reader of his lecture on goiter two facts at once stand out. First, his knowledge of the literature on iodine and goiter up to that time was extraordinarily complete; moreover, he had definite ideas on the role of iodine in the treatment and etiology of goiter. He was familiar with the report of the discovery of iodine by Courtois in 1813 and Coindet's recommendation in 1820 that iodine be used in the treatment of goiter because the element had been found in sponges which had been used therapeutically for centuries. Virchow also knew of Boussingault's and of Chatin's studies of the relationship of the iodine content of soil, air, and water to the prevalence of goiter. Yet, like many others at the time, he was against the use of iodine in the treatment of goiter, saying " It is to be employed with caution . . . because of the dangerous accidents which often follow its use " [28] and " the external application of iodine-containing salves, by which the mechanical action of rubbing is not without significance, is to be preferred to the internal application in slight goiter." [29]

As far as the pathogenesis of goiter is concerned, Virchow discusses the possible role of a lack of iodine in the drinking water and then makes the following statement. " It is hard to imagine that an active, yes, an irritative process, can be caused by a deficiency (*Mangel*) rather than by some positive substance or combination, and the inclination to discover the true goiter stimulus in such a substance will not be overcome until the disease-producing power is definitely proved." [30] This is a clear enough repudiation of the iodine deficiency concept of goiter and of deficiency disease in general. One can only speculate how much of an influence this statement may have had on the development of the deficiency disease concept as a whole.

Virchow recognized the association of goiter and cretinism for he said, " It is a fact that classical endemic cretinism regularly occurs in goiter regions and that up to now we know of no area in the world where

[27] *Ibid.*, p. 4.
[28] *Ibid.*, p. 39.
[29] *Ibid.*
[30] *Ibid.*, p. 59.

cretinism is found with a true endemic distribution where at the same time goiter is not widespread." [31] Elsewhere in discussing the etiology of cretinism, he says, "it is similar to that of goiter. We cannot but trace both diseases to the same kind of influence, and one cannot but regard goiter as the result of a lesser working of the noxious power and cretinism the issue of a stronger influence." [32]

Chlorosis: The disease which later came to be known as chlorosis was called *morbus virgineus* by Johannes Lange in 1554.[33] He describes this malady in a young woman as follows:

> . . . the qualities of her face, which in the past year was distinguished by rosiness of the cheeks and redness of lips, is somehow as if exsanguinated, sadly paled, the heart trembles with every movement of her body, and the arteries of her temples pulsate, and she is seized with dyspnoea in dancing or climbing the stairs, her stomach loathes food and particularly meat, and the legs, particularly the ankles, become edomatous at night."

Thomas Sydenham is credited with advocating the use of iron in the treatment of chlorosis.[34] The rationale for such therapy was put on a firmer basis when iron was demonstrated to be present in the pigment of red blood cells. Quantitative data on the hematin content of normal and diseased (chlorotic) blood are presented by Simon in his *Anthropochemie*.[35] The hematin content of "healthy blood" is given as .6209 percent; a specimen of the blood of a chlorotic female was found to contain .1431 parts hematin per 100 cc. of whole blood. This "girl was 19 years of age, moving in a respectable station and tall; she exhibited all of the symptoms of unmixed, long-standing chlorosis, which appeared in this instance to have reached its highest development." After she had taken "2 ounces of the tincture of iron and 64 grains of metallic iron, during a period of seven weeks," the blood then contained .4598 gms. of hematin. "The changes in the composition of the patient kept pace with those of the blood. Before she was pale, and her lips colourless; now she presented a really blooming appearance." Simon comments that "this change in the composition of the blood is truly surprising, and affords an excellent illustration of the wonderful effects of certain remedies."

[31] *Ibid.*, p. 65.
[32] Virchow: *op. cit.* (ft. 16), p. 931.
[33] J. Lange: De morbo virgineo. Translated by R. H. Major, *Classic Descriptions of Disease*. Springfield: Charles C Thomas, 1932, pp. 445-446.
[34] H. A. Christian: A sketch of the history of the treatment of chlorosis with iron. *M. Library and Historical J.*, 1903, *1*: 176.
[35] Simon: *op. cit.*, pp. 206-210.

As might have been expected, Virchow had knowledge of chlorosis and the effects of iron in the therapy of the disease. The following is found in a lecture "On scientific method and points of view in therapy" which was delivered at a meeting of the Society for Scientific Medicine on December 20, 1847.[86]

How easily has the link with the chemical point of view been made! I shall only recall one of the most striking and at the same time readily available examples of this kind, the treatment of chlorosis with iron, and I refer specifically to the statements concerning it which were made by Carl Mitscherlich on page 15 of his lecture delivered at the founders day of the Fr. Wilhelm Institute on August 2, 1847. Mitscherlich begins with a statement whose foundation, it seems to me, is wanting, namely that completely developed green-sickness (chlorosis) can be cured by no other remedy than iron; indeed, one sees that in many cases of advanced green-sickness iron is not tolerated, while many plant remedies exert a very favorable effect. Now, when the quantity of blood cells increases, as a result of the simultaneous use of iron and protein substances, it does not follow that this increase must depend directly on the passage of iron-containing protein substances into the blood, since hematin, though iron containing is not a protein substance, and in the case of chlorosis the transfer of such an iron containing substance into the blood has not been shown. One could just as well derive from this an increase in growth of hair, which also contains iron. If truly "all symptoms of green-sickness depend on the changed blood," which still remains to be shown, it is nonetheless true that this change in the blood is not the real disease but only the consequence of another kind of change, which we do not yet understand precisely. The formation not only of specific cells but of all cells of the blood is hindered, but how hindered? If it were produced by a deficient intake of iron-containing protein substance, and if the formation of red blood cells depended primarily on this intake, we would probably have difficulty in finding even a single case of chlorosis in young girls from the upper classes, since they take a sufficient quantity of iron and protein in their nourishment to form the necessary quantity of hematin. At most it appears that up to 4 ounces of hematin, containing 2¼ drams of iron, can be found in the blood of the female. Now if one does not arbitrarily wish to assume a rapid turnover of this small quantity, then one must admit that a very insignificant intake is necessary for maintainance at the normal level. The cause of chlorosis must therefore be in some change of the relationship which determines the conditions for normal formation of blood cells and hematin; and if a normal digestion, among other things, belongs among these, then every measure which would bring back to normal the specific digestive change (which, by hypothesis, we shall presuppose in chlorosis) would of necessity be a therapeutic measure for the chlorosis. No one can deny that iron can bring about changes in digestion; therefore, its effect in chlorosis can be related to a change in digestion with just as much right as to a change in the formation of blood cells. Each of these explanations includes a

[86] R. Virchow: Die naturwissenschaftliche Methode und die Standpunkte in der Therapie. *Virchows Arch. f. path. Anat.*, 1849, *2*: 3-37, pp. 19-20.

hypothesis which up to the present cannot be substantiated; the practicing physician gains nothing from attaching himself to one or the other; it suffices for him to know under what circumstances he may hope for success with iron in chlorosis; he has the categorical commitment to keep himself away from hypotheses whose wrong application might cause harm.

The true mode of action of iron in improving chlorosis was not recognized for some time. One of the most astute clinicians of the day, Trousseau, could only explain it as follows:

We may consider iron as the specific for chlorosis, just as mercury and cinchona are specifics for syphilis and marsh fever; and these three medicines administered in three different kinds of anaemia will restore the wasting iron to the blood and muscles, not because they furnish iron to the economy, but because by restoring the organs to a sound state they enable them to accomplish their normal functions, in virtue of which they assimilate the iron contained in the food as in the plenitude of health.[37]

Pellagra: Mal de la rosa or *pelle agra* (pellagra), as the disease had come to be called, was first described in Spain during the 18th century following the introduction of maize from the new world. By the middle of the 19th century the disease was also well-established in France and Italy. Many observers realized that the consumption of maize played a role in the causation of the disease; it was thought that the grain contained a "toxic factor," or that moulds or fungi were present in it.

Pellagra was not prevalent in Germany. Virchow was familiar with the disease, for he had observed cases at first hand during a trip to Milan. His experiences are reported at a meeting of the Society for Scientific Medicine in Berlin on October 18, 1858.[38] The main presentation at this session by von Bärensprung dealt with observations on syphilis, elephantiasis (leprosy) and scabies in Norway. Virchow then talked about pellagra, pointing out the high incidence of the disease in Milan, mentioning that from 1852 to 1855, 3,822 cases had been seen in the Infirmary there. He called attention to the "skin lesions, which are produced by exposure to sun, injury, or scabies and are followed by diarrhea, melancholia, and, finally, dementia."[39] He is further quoted, "The etiology is unknown; one surmises that the disease results from the miserable condition of the people."[40] Virchow had the opportunity to perform an

[37] A. Trousseau: *Lectures on Clinical Medicine.* Translated by Sir John R. Cormack. London: New Sydenham Society, 1872, vol. 5, p. 116.

[38] R. Virchow: Sitzung der Gesellschaft für wissenschaftliche Medicin in Berlin vom 18. Oktober 1858. *Deutsche Klin.*, 1858, *11*: 18-19.

[39] *Ibid.*, p. 19. [40] *Ibid.*

autopsy on a case of pellagra; in the brain he found a large number of *cysticerci*. He concluded that it was unwise to group together all cases under the designation of pellagra and noted that in the latest report of autopsies from Milan hospitals " no conformity " was found.[41] By speculating that " the disease results from the miserable condition of the people," Virchow was doubtless influenced by his observations in Upper Silesia on the interrelations of hunger and typhus ten years before. The entire story of the pathogenesis of the various manifestations of pellagra has not been elucidated even after one hundred years.

Fatty liver: When this metabolic disorder, so often related to nutritional disturbances, is considered, let Virchow tell us about it in his own words:

> It has been known from of old that the *liver* is the organ which is by far the most liable to fall into a state of fatty degeneration, and the knowledge of this state has long derived from popular experiment. The history of the *pâtés de foie gras* proves this in the most agreeable manner, although M. Lereboullet of Strasburg maintains that the fatty livers of geese are physiological ones, essentially different from the pathological ones which are not eaten, but only observed. However, I must confess that I have been unable to discover the difference between physiological and pathological fatty livers; on the contrary, I believe that it is only by admitting the identity of the two that correct notions with regard to the pathological fatty liver can be obtained.[42]

He goes on to say, " Upon studying a fatty liver, it is generally seen that the fat is deposited just in that zone of the acini which is immediately contiguous to the capillaries into which the branches of the portal vein break up." [43] He makes it clear that there is

> no such thing as a fatty liver in which the cells have ceased to exist; these constituents of the organs always exist, only they are almost entirely filled with drops of fat instead of with their ordinary constituents. It can scarcely be doubted that even in this condition they will contain a certain amount of matter capable of performing its functions. For in many animals, as for example the cod-fish from which liver-oil is obtained, the functions of the organ are still performed, however large the quantity of oil contained in the cells. In man, too, even in the most advanced stage of fatty liver we still find bile in the gall bladder. Hence it follows, that a fatty condition of the liver may be removed, that it is curable, without any particular regenerative process required for the cure. The only requisite is, that the causes of the retention be removed, and the hepatic cells be freed from fat. It is true that we have no positive information on either the one or the other of these points." [44]

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[41] *Ibid.*

[42] Virchow: *op. cit.* (ft. 4), p. 370.

[43] *Ibid.*, p. 371.

[44] *Ibid.*, p. 373.

Rickets: Virchow encountered rickets with great frequency in both Würzburg and Berlin. In his writings on rickets he exhibits a thorough knowledge of the literature concerning the disease from the time of Glisson on; the contributions from France by Rufz,[45] Guérin,[46] and Trousseau [47] appear to have impressed him. He was familiar, too, with the results of chemical analyses of the bones which were to be found in Simon's *Anthropochemie*.[48] The inorganic content of specimens from individuals with rickets and osteomalacia was reduced.

His main contribution to our understanding of rickets was that "the disturbance produces nothing new." [49] In other words there was no proliferation of a new type of tissue as had been supposed, but, in accordance with his basic concepts, the excess cartilage and bone represented merely an increase of the normal, derived from the cells already present. Virchow examined tissues with the microscope and noted differences in the distribution of inorganic materials. Finally, he concluded that the disease did not consist of a softening of the old bone but rather a failure of newly-formed matrix to "solidify." [50]

It is of interest that Trousseau [51] had presented evidence in 1844 that cod liver oil was beneficial in the treatment of rickets. These observations appear to have made little impression on Virchow, or anyone else, for that matter.

Scurvy: By 1858, adult scurvy had been a well documented syndrome for centuries.[52] Described by the Crusaders and observed during the voyages of Vasco da Gama, Magellan, and Cartier, the disease had received further attention from the medical writers of the following centuries. Virchow knew about scurvy and was apparently on the lookout for it on his trips to Upper Silesia and the Spessart, for in his report on typhus he speaks of scurvy and was familiar with the fact the disease resulted

[45] M. Rufz: Recherches sur le rachitisme chez les enfans. *Gaz. méd. de Paris*, 1834, 2.s. *2*: 65-70.

[46] J. Guérin: Mémoire sur les caractères généraux du rachitisme. *Ibid.*, 1839, 2.s. *7*: 433, 449, 481.

[47] A. Trousseau: Du rachitisme. *Gaz. d. hôp.*, 1848, *10*: 147-149, 164-165, 185, 263-264.

[48] Simon: *op. cit.*, pp. 505-509.

[49] R. Virchow: Das normale Knochenwachsthum und die rachitische Störung desselben. *Virchows Arch. f. path. Anat.*, 1853, *5*: 409-507, p. 421.

[50] Virchow: *op. cit.* (ft. 4), p. 476.

[51] A. Trousseau: Rachitis. Huile de foie de morue. *J. de méd.* (*Paris*), 1844, *2*: 321-324.

[52] A. Hirsch: *Handbuch der historisch-geographischen Pathologie*. Erlangen: F. Enke, Vol. I, 1860, pp. 521-552.

from the want of "all vegetable food or too little variety in aliments."[53] Yet he appears not to have regarded scurvy as a distinct disease but rather as an example of "a dyscrasia which is dependent upon a permanent supply of noxious ingredients from certain sources." He goes on to say,

> the essential point, therefore, is to search for the local origins of the different dyscrasiae, to discover the definite tissues or organs from which this derangement in the constitution of the blood proceeds. Now I am quite willing to confess that it has not in many cases hitherto been possible to find out these tissues or organs. In many instances, however, success has been obtained, although it cannot be said in every case in what way the blood has become changed. Thus we have that remarkable condition, which may very well be referred to as dyscrasia, the scorbutic condition, purpura, and the petechial dyscrasia. In vain will you look around for decisive information as to the nature of this dyscrasia. There remains in this case, therefore, a *quid ignotum*, and you will, I am sure, deem it excusable, if we are unable to say whence a dyscrasia proceeds, of which we are altogether unacquainted with the nature.[54]

Before leaving the knowledge of scurvy in such a deplorable state Virchow can be allowed to redeem himself as a result of his studies on the intercellular substances of connective tissues, which today we know to be the materials which are affected in the scorbutic state. For he says,

> I have therefore considered necessary, and I believe you will derive benefit from the conception, to portion out the body into cell-territories (Zellenterritorien). I say territories, because we find in the organization of animals a peculiarity which in vegetables is scarcely at all to be witnessed, namely, the development of large masses of so-called *intercellular substance*, . . . the *intercellular substance is dependent* in a certain definite manner upon the cells, and it is necessary to draw boundaries in it also, so that certain districts belong to one cell, and certain others to another.[55]

The role of connective tissues cells in the elaboration of collagen was well brought out by Wolbach in studies of healing experimental scorbutus.[56] To one who has been interested in cartilage for many years it is amazing to read Virchow's description of these cells, "which form peculiar jagged corpuscles, which one might be readily tempted to confound with branched

[53] Virchow: *op. cit.* (ft. 19).
[54] Virchow: *op. cit.* (ft. 4), pp. 162-163.
[55] Virchow: *op. cit.* (ft. 4), pp. 40-42.
[56] S. B. Wolbach: Controlled formation of collagen and reticulum. A study of the source of intercellular substance in recovery from experimental scorbutus. *Am. J. Path.*, 1933 (Supp.), *9*: 689-700.

cells," [57] and then, utilizing an "anatomical innovation," [58] the electron microscope, to observe the true nature of the surfaces of cartilage cells.[59]

To sum up, by 1858, the time of publication of *Die Cellularpathologie*, sufficient data for the synthesis of a deficiency disease concept were at hand. The suitability or unsuitability of certain diets was recognized, and disease might result from the latter. Virchow had commented on the potato in this regard. Iodine deficiency had been advocated, though discarded, as a cause of goiter. Iron had been shown to be effective in the treatment of chlorosis. Fresh vegetables and citrus fruits were well-recognized as preventives or cures for scurvy. Trousseau had brought forth dramatic evidence on the effectiveness of cod liver oil in the treatment of rickets. Yet the time was apparently not ripe; neither Virchow nor his contemporaries had grasped what today seems so obvious.

III

How are we to explain this failure to formulate some sort of an hypothesis concerning the pathogenesis of these diseases? Perhaps the most important reason is that a true appreciation of etiological factors in disease had to come before any concept based on a lack of something could be formulated. An etiological classification of disease was some time in being developed. As Faber [60] has pointed out, the nosological approach to disease passed through a series of stages. Morbid entities first were classified with respect to symptomatology. Then came the anatomical approach by the Paris group, to be followed by the physiological system of the German school. Only by mid-century had thoughts begun to turn to causes. In 1840 Henle's treatise dealing with *miasms* and *contagia* had appeared.[61] Virchow himself speaks of "a diffusible agency, a miasma," when discussing the etiology of cretinism.[62] During 1859-60 Claude Bernard gave a series of lectures on experimental pathology in Paris.[63] Two were devoted to "The analogy between morbid causes and poisons,"

[57] R. Virchow: Die Identität von Knochen-, Knorpel-, und Bindgewebekörperchen, sowie über Schleimgewebe. *Verhandl. d. phys. med. Gesellsch. in Würzburg*, 1851, *2*: 150.

[58] Virchow: *op. cit.* (ft. 4), p. 28.

[59] R. H. Follis, Jr.: Biology of chondroitin sulfates. *Trans. Conference on Polysacchrides in Biology*, Josiah Macy, Jr., Foundation, 1959, p. 57.

[60] K. Faber: *Nosography in Modern Internal Medicine*. New York: P. B. Hoeber, Inc., 1923.

[61] F. G. J. Henle: *On Miasmata and Contagia*. Trans. by G. Rosen, Baltimore: Johns Hopkins Press, 1938.

[62] R. Virchow: *op. cit.* (ft. 16), p. 934.

[63] C. Bernard: *Leçons de pathologie expérimentale*. Paris: J. B. Baillière et fils, 1872.

and several others dealt with poisons in general. Here was a definite effort to reproduce disease by the introduction of specific external agents.

But more important was the rise of bacteriology, for the discovery that diseases could be produced by microorganisms and their products created a revolution. Virchow helped to develop this story in a lecture which he delivered in 1868.[64]

> The old world referred every unusual appearance to special and divine intervention. If they believed in many gods, it was then one of those who sent the scourge. If they believed in one God, it was presumed to be a dispensation from Him. Herewith all research, properly so-called, was at an end. For would it not be audacious for the finite spirit of a mortal to divine some reason for a divine act? However terrible a burden the plagues which the Deity sent were to bear, there was no alternative but to suffer them with humility. At most one should meditate on one's own sinfulness and, by atonement for the wrongs committed, hope to avert the wrath of God from oneself and one's family.
>
> To this the nations of the East added their belief in the stars. These, too, after all, were heavenly bodies raised far above terrestrial vicissitudes; it was but a step to invest them with a sort of personality, nay even to take them for divine emanations fitted out with miraculous powers. The sun and the sun-God, the moon and the Goddess of the moon blended into one: symbol and reality were no more two but one.
>
> Notions of this hazy and therefore intangible sort ruled human thought till far into the Middle Ages.

Virchow now can speak of a disease with which he was familiar.

> If we now consider the conditions which favour the development of typhus fever, or in the strictest sense of the word the *causes* of the disease, we must first of all call attention to the fact, that through almost every century one fundamental notion has governed the opinions of both medical and lay observers relative to the nature of typhus diseases, viz., that the human body becomes impregnated with some substance foreign to it and therefore injurious, which substance represents the center point of the malady. The ancients called it "unclean" (*miasma*), and the condition of the human body which its reception occasioned an uncleanness (*infectio*). In the large manual of pathology and therapeutics which I am publishing in conjunction with some eminent German clinical authorities, I recently restored this conception by classing them all in the corresponding section under the name of infectious diseases (*Infectionskrankheiten*).
>
> But what is this unclean substance? And whence comes it? It used to be the custom to derive it from a sort of foulness or corruption now in the air, now in the water or in the food; hence the term putrid fever which has so frequently been given as the generic title to the whole group of fevers here treated. The greatest stress was laid on the corruption of the air in this system. With this are connected to some extent the attempts of some isolated new men to discover closer ties between typhus and widespread disease in animals and plants.[65]

[64] Virchow: *op. cit.* (ft. 21), pp. 19-20.

[65] Virchow: *Ibid.*, p. 31.

These words of Virchow bring us to the era of bacteriology, which was to dominate the last quarter of the century. It is hard today for us to realize the influence which "germs" had on concepts of causation of diseases. Bacteriology placed emphasis on the *positive* effects of microorganisms and their products. Some thought that, in time, a causative agent would be found for every disease. During the latter part of the 19th century and first part of this one, all of the still to be defined deficiency diseases had one or more animate agents suggested and frequently proved as their cause; such was the case with goiter, scurvy, pellagra, rickets, and beriberi. One has only to recall that even as late as 1916 Goldberger was forced to go to what seem like needless efforts to show that pellagra was not infectious in nature. He attempted to reproduce the disease in himself, his wife, and co-workers by injecting them with the blood from pellagrous patients, by swabbing their nasopharyngeal tissues with secretions from pellagrins, and inoculating them with skin scales.[66]

As a result of the tremendous influence of these positive agents, the bacteria and their products, it was difficult to think in terms of negative causes of disease. Medical science, just as has the law, had difficulty even considering, much less proving, a negative, particularly in the face of all the positive factors. Even as late as 1907, Marine has said that he "frequently heard the criticism that it was difficult to conceive of a deficiency or absence of something causing something."[67] In addition, we find an extraordinary disinterest by some, such as is indicated by the following from Osler's *Textbook of Medicine* (1897):[68]

> The treatment of chlorosis affords one of the most brilliant instances—of which we have but three or four—of the specific action of a remedy. Apart from the action of quinine in malarial fever, and of mercury and iodine of potassium in syphilis, there is no other drug, the beneficial effects of which we can trace with the accuracy of a scientific experiment. It is a minor matter *how* (Osler's italics) iron cures chlorosis.

Fortunately, however, influences were at work, trends which were to lead to the formulation of a deficiency disease concept. These came from several directions: a better understanding of the *natural history of human disease syndromes* through improved clinical, dietary, roentgeno-

[66] J. Goldberger: The transmissibility of pellagra; experimental attempts at transmission to the human subject. *Pub. Health. Rep.*, 1916, *31*: 3159-3173.

[67] D. Marine: Endemic goiter: problem in preventive medicine. *Ann. Int. Med.*, 1954, *41*: 875.

[68] W. Osler: *The Principles and Practice of Medicine.* New York: D. Appleton and Co., 1897, p. 800.

logical, and post mortem observations; studies of *experimental nutritional disease*; and advances in *physiological chemistry*, particularly endocrinology. By 1860 an occasional voice had begun to be heard from those who were studying human disease syndromes, either historically or at first-hand. Hirsch, writing on the history of scurvy,[69] was forced to conclude,

> We must look for the etiological factor of this disease in the deficiency (Mangel) of a nutritious substance, which, as experience has taught us many times, is inherent in the consumption of vegetable food, in fact foodstuffs going by the name of "greens." The appearance of scurvy as soon as a deficiency of these foodstuffs arises, the decrease and disappearance of the disease as soon as these foodstuffs are administered again, are facts so often observed that the obvious explanation can hardly be disputed.

Scurvy in adults, as has already been mentioned, had been recognized for several centuries. Yet not until the latter part of the 1800's was this disease delineated in infants. In 1883 Thomas Barlow [70] wrote, "On cases described as 'acute rickets' which are probably a combination of scurvy and rickets, the scurvy being an essential, and the rickets a variable, element." Soon after, a number of careful autopsy studies [71 72] placed the pathologic lesions on a firm foundation, particularly those in the skeleton which could be diagnosed during life by the newly discovered x-rays.[73]

Another disease which had begun to receive attention was beriberi. Wernich, during a trip around the world, had stopped in Japan and there observed *Kakke* or beriberi.[74] Virchow published Wernich's autopsy records in the *Archiv*.[75] Wernich looked upon beriberi as a blood disease similar to pernicious anemia and went even further to say that the latter malady, "like beriberi, scorbutus, chlorosis, etc., belongs to a class of

[69] Hirsch: *op. cit.*, p. 551.

[70] T. Barlow: On cases described as "acute rickets" which are probably a combination of scurvy and rickets, the scurvy being an essential, and the rickets a variable, element. Royal Medical and Chirurgical Society of London: *Med.-Chir. Tr.*, 1883, *66*: 159-220.

[71] O. Naegeli: Zur pathologischen Anatomie und zum Wesen des Morbus Barlow. *Zentralbl. f. allg. Path. u. path. Anat.*, 1897, *8*: 687-694.

[72] G. Schmorl: Zur pathologischen Anatomie des Barlow 'schen Krankheit. *Beitr. z. path. Anat. u. z. allg. Path.*, 1901, *30*: 215-266.

[73] E. Fraenkel: Untersuchungen über die Möller-Barlowsche Krankheit. *Fortschritte auf dem Gebiet der Röntgenstrahlen*, 1906-07, *10*: 1.

[74] A. Wernich: *Geographisch-medicinische Studien nach den Erlebnissen einer Reise um die Erde*. Berlin: A. Hirschwald, 1878.

[75] A. Wernich: Klinische Untersuchungen über die Japanische Varietät der Beriberi-Krankheit. *Virchows Arch. f. path. Anat.*, 1877, *71*: 290-363.

constitutional diseases brought about by disturbances in nutrition." [76] This is, of course, an amazing conclusion concerning pernicious anemia, a disease which was not officially added to the deficiency group until more than 50 years later. Studies comparing the rations of groups with and without beriberi had convinced Takaki [77] that this disease had its origin in the diet. As a result, the disease was eradicated from the Japanese Navy.

Pathologic studies of pellagra began to be recorded in the middle part of the century.[78] By 1910 this disease had appeared with explosive violence in the United States. Its relation to diet was clearly established when Joseph Goldberger, who was an accomplished epidemiologist, had studied the disease for only a short time.[79]

The pathologic anatomy of rickets was fully elucidated by Pommer in 1885,[80] yet the pathogenesis of the disease was far from being understood, even though Schabad by 1910 had demonstrated a loss of calcium in the stools and had presented some evidence as to the mode of action of cod liver oil.[81] A complete understanding of rickets had to wait, however, until methods for the determinations of serum-calcium and phosphorus could be provided by the biochemist; these then could be correlated with the x-ray evidence of healing in order to judge the effectiveness of therapy with cod liver oil. Dr. E. A. Park has told me that he feels that the main reason for the abandonment of cod liver oil, which had so strongly been advocated by Trousseau as early as 1848,[82] was that no objective way of assessing improvement following therapy was available until chemical and x-ray methods were introduced.

Tetany is a syndrome which had been intimately associated with certain cases of rickets. This disease state, which is characterized by convulsive seizures associated with fibrillary twitchings and spasms of the muscles in the extremities and larynx, had been recognized in infants for

[76] A. Wernich: Ueber die Beziehungen zwischen sogenannter perniciöser Anämie und Beriberikrankheit. *Deutsche Arch. f. klin. Med.*, 1887, *21*: 108.

[77] K. Takaki: Special report of the kakke patients in the Imperial Japanese Navy from 1878 to 1886. *Tr. Sei-I-Kwai*, 1887, *6*: 73-74, 95-100.

[78] M. Fränkel: Leichenbefunde bei Pellagra. *Virchows Arch. f. path. Anat.*, 1869, *49*: 579-582.

[79] J. Goldberger: The etiology of pellagra. The significance of certain epidemiological observations with respect thereto. *Pub. Health Rep.*, 1914, *29*: 1683-1686.

[80] G. Pommer: *Untersuchungen über Osteomalacie und Rachitis.* Leipzig: F. C. W. Vogel, 1885.

[81] J. A. Schabad: Zur Bedeutung des Kalkes in der Pathologie der Rachitis. IV. Der Kalkstoffwechsel bei Rachitis. *Arch. f. Kinderh.*, 1910, *53*: 380-414.

[82] Trousseau: *loc. cit.* (ft. 54).

at least two centuries. The role of serum-calcium in the pathogenesis of tetany and the intimate relationship of the parathyroid gland to calcium homeostasis was shown by MacCallum and Voegtlin [83] in 1909. Hence tetany appeared to be a calcium deficiency disturbance, at least as far as the serum was concerned.

The association of night blindness and a lesion of the conjunctiva had first been recognized by Pierre Bitot in 1862.[84] The relationship of faulty nutrition and eye disease was pointed out by Mori in 1904.[85] He suggested that the ocular lesions which he had observed in a large number of Japanese children were due to lack of fat in the diet.

This then represents the state of knowledge concerning certain deficiency syndromes up to, and a little past, the turn of the century. Such knowledge was based on clinical and pathologic studies of naturally-occurring diseases in man. Yet just as important were the contributions from the laboratory. For in the formulation of the deficiency disease concept, experimental studies played a most decisive role. From the end of the 19th century on one begins to find titles in the literature which describe work which was being pursued in the laboratory: "Bedeutung der anorganischen Salze für die Ernährung des Thieres"; [86] "In welcher Form wird das Eisen resorbirt?"; [87] "Eine Beri Beri-ähnliche Krankheit der Hühner"; [88] "Observations on the effect of adding tryptophane to a dietary in which zein is the sole nitrogenous constituent"; [89] "On the etiology of scurvy"; [90] "Colloid glands (goiters): their etiology and physiological significance"; [91] "Experimentelle Beiträge zur Aetiologie der Kerato-

[83] W. G. MacCallum and C. Voegtlin: On the relation of tetany to the parathyroid glands and to calcium metabolism. *J. Exper. Med.*, 1909, *11*: 118-151.

[84] P. Bitot: Mémoire sur une lésion conjonctivale, non encore décrite, coïncidant avec l'héméralopie. *Bull. Acad. de méd.*, Paris, 1862, *28*: 619.

[85] M. Mori: Über den sog. Hikan (Xerosis conjunctivae infantum ev. Keratomalacie). *Jahrb. f. Kinderh.*, 1904, *59*: 175-195.

[86] N. Lunin: Ueber die Bedeutung der anorganischen Salze für die Ernährung des Thieres. *Hoppe-Seyler's Ztschr. f. physiol. Chem.*, 1881, *5*: 31-39.

[87] C. A. Socin: In welcher Form wird das Eisen resorbirt? *Ibid.*, 1891, *15*: 93-139.

[88] C. Eijkman: Eine Beri Beri-ähnliche Krankheit der Hühner. *Virchows Arch. f. path. Anat.*, 1897, *148*: 523-532.

[89] E. G. Willcock, and F. G. Hopkins: The importance of individual amino acids in metabolism. Observations on the effect of adding tryptophane to a dietary in which zein is the sole nitrogenous constituent. *J. Physiol.*, 1906-1907, *35*: 88-102.

[90] A. Holst, and T. Frölich: Experimental studies relating to ship-beriberi and scurvy. II. On the etiology of scurvy. *J. Hyg.*, 1907, *7*: 634-671.

[91] D. Marine, and C. H. Lenhart: Colloid glands (goitres): their etiology and physiological significance. *Bull. Johns Hopkins Hosp.*, 1909, *20*: 131-139.

malacie";[92] "The production in dogs of a pathological condition which closely resembles human pellagra";[93] "Studies on experimental rickets."[94]

The titles of some of these researches indicate that disease syndromes, physiologically and morphologically similar to those occurring naturally, could be produced and studied in laboratory animals. Hence, the time was at hand when more precise information could be obtained concerning the nature of the materials, which, when lacking, led to a specific disease state. In time the exact chemical structure of these substances might be delineated.

A further influence on the development of the deficiency disease concept was the rise of physiological chemistry. Two areas were important here: the chemical analysis of diseased tissues and the emergence of endocrinology. In the first category mention has already been made of data supplied by a treatise such as Simon's [95] on the iron content of the blood in cases of chlorosis and the decrease in mineral content of the bone in rickets. Other examples of evidences of chemical abnormalities were the decrease in digestibility of coagulated egg white by gastric juice in cases of pernicious anemia as shown by Fenwick,[96] and the demonstration of iodine in the thyroid gland by Baumann in 1895.[97] The correlation of the iodine content of the thyroid with histological structure of the gland by Marine and Williams [98] in 1907 helped to lay the foundations of modern thyroidology.

The beginnings of endocrinology virtually coincided with the publication of *Die Cellularpathologie*. Addison's monograph, *On the Constitutional and Local Effects of Disease of the Supra-renal Capsules*, appeared in 1855.[99] His observations immediately stimulated Brown-Séquard to

[92] M. Goldschmidt: Experimenteller Beitrag zur Aetiologie der Keratomalacie. *Arch. f. Ophth.*, 1915, *90*: 354.

[93] R. H. Chittenden and F. P. Underhill: The production in dogs of a pathological condition which closely resembles human pellagra. *Am. J. Physiol.*, 1917, *44*: 13-66.

[94] E. V. McCollum, N. Simmons, H. T. Parsons, P. G. Shipley, and E. A. Park: Studies on experimental rickets. I. The production of rachitis and similar diseases in the rat by deficient diets. *J. Biol. Chem.*, 1921, *45*: 333-342.

[95] Simon: *op. cit.*, pp. 206-210, 505-509.

[96] S. Fenwick: Atrophy of the stomach. *Lancet*, 1877, *2*: 1, 39-41, 77-78.

[97] E. Baumann: Ueber das normale Vorkommen von Jod im Thierkörper. *Hoppe-Seyler's Ztschr. f. physiol. Chem.*, 1895, *21*: 319-330.

[98] D. Marine and C. H. Lenhart: Further observations on the relation of iodin to the structure of the thyroid gland in the sheep, dog, hog, and ox. *Arch. Int. Med.*, 1909, *3*: 66-77.

[99] T. Addison: *On the Constitutional and Local Effects of Diseases of the Supra-renal Capsules*. London, 1855.

study the dramatic effects of extirpating the adrenal glands from dogs; the publication of these observations was another important contribution for the year 1858.[100] The story of thyroid deficiency disease or myxedema and, in 1882, its surgical production in man, is well-known.[101] So, too, the effects of parathyroid ablation and the relation of these glands to tetany was elucidated before the turn of the century.[102] Hence, studies of adrenals, thyroid, and parathyroids, as well as other endocrine glands, clearly showed their relation to naturally-occurring disease or artificially-produced disturbances in man and experimental animals. Rational means for combating such effects by extracts of the tissue in question could then be developed. The concept of endocrine deficiency disease was therefore established in its own right; it added further proof to the concept of deficiency disease in general.

As has been mentioned, Hirsch [103] had stated in 1860 that, "The etiological factor of this disease (scurvy) is a deficiency of a nutritive substance." A little later Wernich had grouped berbiberi with such diseases as pernicious anemia, scorbutus, and chlorosis as examples of "constitutional diseases brought about by disturbances in nutrition." [104] Writing in his textbook, *Diseases of Infancy and Childhood*, L. E. Holt in 1898 [105] makes the statement,

> The diseases due to faulty nutrition are really numerous. There are two which have been so clearly shown to originate in this way that they may be singled out and put in a class by themselves. These are scorbutus and rickets. The prevailing view of the medical profession is that both of these are essentially food diseases. The purpose of considering them in connection with the disturbances of nutrition is to emphasize this relationship.

Hence, by 1900, the time appeared ripe for the concept of deficiency disease finally to be stated in a more formal fashion.

F. G. Hopkins [106] seems to have been one of the first to be aware of

[100] E. Brown-Séquard: Nouvelles recherches sur l'importance des fonctions des capsules surrénales. *J. de la physiol. de l'homme, et des animaux*, 1858, *1*: 160-173.

[101] S. Bornhauser: *Zur Geschichte der Schilddrüsen und Kropfforschung im 19. Jahrhundert.* Publications de la Société suisse d'histoire de la médecine et des sciences naturelles, XIX. Aarau: Sauerländer & Co., 1951.

[102] E. Gley: Des effets de l'extirpation des glandules parathyroïdes chez le chien et chez le lapin. *Compt. rend. Soc. de biol.*, 1897, 10 s, *4*: 18-20.

[103] Hirsch: *op. cit.*, p. 552.

[104] Wernich: *loc. cit.* (ft. 76).

[105] L. E. Holt: *The Diseases of Infancy and Childhood.* New York: D. Appleton and Co., 1898, p. 209.

[106] F. G. Hopkins: The analyst and the medical man. *Analyst*, 1906, *31*: 385.

"unsuspected dietary factors" and their relation to "the health of the individual." For he says

No animal can live upon a mixture of pure protein, fat, and carbohydrate, and even when the necessary inorganic material is carefully supplied the animal still cannot flourish. The animal body is adjusted to live either upon plant tissues or the tissues of other animals, and these contain countless substances other than the proteins, carbohydrates, and fats. Physiological evolution, I believe, has made some of these well-nigh as essential as are the basal constituents of diet. The field is almost unexplored; only is it certain that there are many minor factors in all diets of which the body takes account.

Scurvy and rickets are conditions so severe that they force themselves upon our attention; but many other nutritive errors affect the health of individuals to a degree most important to themselves, and some of them depend upon unsuspected dietetic factors.

A few years later the importance of an inorganic element, iodine, for the normal structure of the thyroid gland was elucidated by Marine[107] who clearly called attention to the place of goiter among "nutritional disturbances."

In view of the evidence thus far deduced we believe that goiter must be classed with the nutritional disturbances (diseases) and that as such it will take its place in nosology along with chlorosis, rachitis, osteomalacia, etc.

Then in 1912 came the final synthesis by Casimir Funk,[108] who specified that certain syndromes belong to the "deficiency disease" group and coined the term "vitamine."

All these diseases (beriberi, scurvy, pellagra, sprue, and rickets) can be prevented and cured by the addition of certain preventive substances; the deficient substances, which are of the nature of organic bases we will call vitamines.

At the same time Vedder,[109] who had been studying beriberi, marshalled the evidence which clearly placed this syndrome in the deficiency disease group.

The main question as to the etiology of beriberi has been settled, and the key to the solution of the minor puzzles that yet remain is in our hands. Moreover, the facts which have been discovered with regard to beriberi have thrown a great light upon other diseases such as scurvy, and have revolutionized our ideas with regard to the metabolism of the body.

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[107] D. Marine and W. W. Williams: The relation of iodine to the structure of the thyroid gland. *Arch. Int. Med.*, 1908, *1*: 349-384, p. 381.

[108] C. Funk: The etiology of the deficiency diseases. Beriberi, polyneuritis in birds, epidemic dropsy, scurvy, experimental scurvy in animals, infantile scurvy, ship beriberi, pellagra. *J. State Med.*, 1912, *20*: 341-368.

[109] E. B. Vedder: *Beriberi*. New York: William Wood and Co., 1913, p. iii.

An interesting sidelight on the changing concepts of nosology from 1912 to 1915 is shown by the classification of certain diseases in the *Index Medicus* during this period.[110] In 1912, both beriberi and pellagra were listed under the category, "Diseases due to specific infections"; rickets was classified under "Diathetic disease," while scurvy, goiter and chlorosis appear among "Diseases of the blood, lymphatics and ductless glands." In 1913, pellagra appears in the classification "Intoxications"; beriberi joined it here in 1914. Finally in 1915, beriberi, pellagra, rickets, and scurvy are grouped among the "Diathetic and deficiency diseases."

In 1918 came the publication of E. V. McCollum's, *The Newer Knowledge of Nutrition*.[111] A year later appeared the British Medical Research Council's, *Report on the Present State of Knowledge Concerning Accessory Food Factors (Vitamines)*,[112] where the following appears:

> Disease is so generally associated with positive agents—the parasite, the toxin, the *materies morbi*—that the thought of the pathologist turns naturally to such positive associations and seems to believe with difficulty in causation prefixed by a *minus* sign. Even in connexion with deficiencies arising within the body there is or was a similar tendency. When the importance of internal secretions was first recognized there seemed to be much hesitation in believing that symptoms might be frankly due to their failure. When each fresh internal secretion was described there was always an effort to show that its function was to "neutralize" some, always hypothetical, toxic substance. Symptoms, on this view, were due to the unmasking of a deleterious agent rather than to simple deficiency in a normal and necessary agent. To distinguish between these two possibilities was of course a scientific duty; but, at any rate in the earlier literature of internal secretions, a bias against the simpler view interfered with the fair interpretation of experimental results.

Thus the concept of deficiency disease, which had developed from clinical and pathological studies in man and from there to experimental disease in the laboratory, soon reached a point where anatomical and biochemical studies of diseased cells might be expected to throw much light on how such abnormalities came about. Therefore, it is not surprising to find Wolbach [113] saying in 1936:

[110] F. H. Garrison, Editor: *Index Medicus. A Monthly Classified Record of the Current Medical Literature of the World*, Second Series, Vols. *10*, 1912; *11*, 1913; *12*, 1914; and *13*, 1915.

[111] E. V. McCollum: *The Newer Knowledge of Nutrition*. New York: The MacMillan Co., 1918.

[112] Medical Research Council: *Report on the Present State of Knowledge Concerning Accessory Food Factors (Vitamines)*. Special report series, No. 38. London: His Majesty's Stationery Office, 1919.

[113] S. B. Wolbach: Vitamin deficiency experimentation as a research method in biology. *Science*, 1937, *86*: 569-576.

The steady progress in understanding of the biochemistries of vitamins now obtainable in pure form is a challenge to the cytologist because in some instances it should be possible to determine the loci, within cells, of vitamin activities. The opportunity of associating chemical activities or functional roles within nuclear and cytoplasmic structures appears to be at hand.

At the same time another era began as Rudolf Peters [114] stated in 1936:

We are so accustomed to the detailed analysis upon the fixed tissue which is made possible by refined histological methods that we do not readily adjust to the idea that a new type of analysis is being steadily perfected by modern biochemical research. So far as the separation of one cell from another is concerned and the elucidation of differences, biochemistry is still very crude. We cannot work upon much less than 50 mg. of wet tissue, but we can obtain information from this of changes too subtle to be revealed upon the fixed histological specimen, changes in the behavior of essential enzyme systems present. It really constitutes a new approach to pathological analysis.

Structural changes in the cell as Virchow knew them can today be produced in the laboratory with ease by a variety of procedures. He would be entirely at home with *fatty degeneration* of the liver, whether periportal as a result of protein deficiency or central due to choline lack; *metaplasia* of normal epithelial cells to a stratified keratinizing type as a result of vitamin A deficiency; excess or decrease of *pigment* in various tissues; *necrobiosis* of the heart as a result of either potassium or thiamine deficiencies; *scurvy* due to ascorbic acid deficiency; *rickets* resulting from a lack of calcium, phosphorus, or vitamin D; *struma* due to a lack of iodine or the presence of goitrogens; and *gelatinous degeneration* of nervous tissues produced by deficiencies of several different vitamins. As Virchow knew so well, these morphological states are merely examples of disturbances of normal structure and function.

Yet Virchow, like his contemporary Claude Bernard, realized that disease might be present even when cells appeared normal under the microscope. The great Frenchman said in one of his *Lectures on Experimental Pathology*, " A poison being introduced into the economy, the animal dies; a series of morbid phenomena have been produced, the explanation of which is not always forthcoming when the autopsy is made." [115] And again, " Morbid anatomy must not be considered as the key to all the phenomena of disease: viewed by itself it is utterly uncapable of pointing out the hidden sources from which they spring; and more anatomical

[114] R. A. Peters: The biochemical lesion in vitamin B_1 deficiency. Application of modern biochemical analysis to its diagnosis. *Lancet*, 1936, *1*: 1161-1172.

[115] Bernard: *op. cit.*, p. 103.

investigations, however minute, are altogether insufficient in this respect." [116] Such concepts of Bernard, to which Virchow also subscribed, were perhaps slower than might have been expected to become established, so strong was the dominance of pathological anatomy. Yet today the concept of the "biochemical lesion" which was elucidated by Peters [117] shares equally in importance with the structural changes whereby we recognize disease. Alterations in cells, whether they be based on structural or physiological changes, merely strengthen the concept of cellular pathology. Though some would speak of "molecular pathology," [118] such alterations are due to damage within the cells themselves. Over a 100 years later the dictum: *omnis cellula e cellula* remains entirely valid.

We have seen how the deficiency disease concept developed as a result of clinical and pathological observations on naturally-occurring syndromes in man and their response to dietary or exogenous factors. So, too, studies on experimental animals, which placed the concept on an even firmer foundation, came from observations on various species from the diets of which one or more of the so-called essential nutrients, now numbering over 40, had been removed. However, it soon became apparent that non-dietary disease was also of importance. The term "conditioned" deficiency [119] was introduced to refer to situations which lead to a failure of cells and tissues to receive essential nutrients as a result of poor absorption, interference with storage, excess excretion, drain from the organism, or increased requirements. This obviously broadened the concept of deficiency disease, particularly the human syndromes. Entities such as the hypokalemic syndrome, the low-sodium syndrome, the hypoglycemic syndrome, pernicious anemia, and the malabsorption syndrome have now come to be full-fledged members of the deficiency disease group. Moreover, it is apparent that a lack of specific enzymes which control the metabolism of inorganic elements, amino acids or proteins, carbohydrates, lipids, and even vitamins, can lead to deficiency states. Since many of these defects are genetic in character, is it carrying things too far to regard them as inherent protein, that is, nucleoprotein deficiency states?

[116] *Ibid.*, p. 119.

[117] Peters, *op. cit.*

[118] H. Schade: Die Molekularpathologie in ihrem Verhältnis zur Zellularpathologie und zum klinischen Krankheitsbild am Beispiel der Entzündung. *München. med. Wchnschr.*, 1924, *71*: 1-4.

[119] N. Jolliffe: Conditioned malnutrition. *J. A. M. A.*, 1943, *122*: 299-306.

Furthermore, in view of what is now known of the biosynthesis of ascorbic acid, may not scurvy be regarded as the result of a lack of an enzyme necessary for the synthesis of ascorbic acid from certain precursors and not primarily a dietary deficiency disease at all? Hence, the endogenous deficiency states become as important, or even more so, than those produced by a lack of exogenous factors. This then is the broadening concept of deficiency disease today, a field whose horizons will undoubtedly be widened further in the centuries of cellular pathology to come.

DE SANGUINE EPISCOPOQUE

A Discussion of Bishop Robert Grove [1634-1696] and his *Carmen de sanguinis circuitu, &c.* (1685)

L. R. C. AGNEW

In 1685 an interesting and unusual poem written in Latin and entitled *Carmen de sanguinis circuitu, a Gulielmo Harvaeo Anglo, primum invento* was published (Fig. 1).[1] The author was Robert Grove (1634-1696) who later (1691) became Bishop of Chichester. The poem is written in heroic hexameters and is partly descriptive of Harvey demonstrating the circulation of the blood in a dog, and partly a sort of running commentary by Harvey himself. In 1912, a partial translation was published by Ashhurst who observed that the poem " has in many places a truly epic flow; in others the rhythm is harsh, and the meter not always impeccable. There is great redundancy of adjectives, which makes a readable translation difficult, and the mixed metaphors in which the poem abounds render even a free translation rather ludicrous in places." [2] Ashhurst made his translation at the request of S. Weir Mitchell who felt that " this curiously definite statement justifies the belief that the author must have seen at Oxford demonstrations by Harvey on the living animal." [3] Now Harvey was at Oxford from November, 1642, until November, 1646, but, as Robb-Smith has recently commented, " it is extremely unlikely that Grove ever saw Harvey give such a demonstration and certainly not at Oxford, as Grove was only born in 1634 and obtained his B. A. from St. John's College, Cambridge, in 1657!" [4]

It is interesting to note that Weir Mitchell's attention was first drawn

[1] This is not a particularly rare book—Wing (2148) records copies in nine libraries: British Museum; Bodleian; Cambridge; Trinity College, Cambridge; Geoffrey Keynes; Harvard; Osler (McGill); University of Michigan; Cushing (Yale). There are also copies in the Clendening Medical Library (University of Kansas), the Boston Medical Library, Boston Public Library, and the Library of the College of Physicians of Philadelphia, and it is likely that additional copies are in other institutional and private collections. The poem was reprinted, without the prefatory *Ad lectorem*, in the first and second editions (1692, 1699; Wing 3135, 3136) of volume 1 of *Musarum Anglicanarum analecta*.

[2] A. P. C. Ashhurst in S. Weir Mitchell's *Some Recently Discovered Letters of William Harvey With Other Miscellanea* (Philadelphia: College of Physicians of Philadelphia, Transactions, 1912), p. 42.

[3] *Op. cit.*, p. 41.

[4] A. H. T. Robb-Smith, "Harvey at Oxford." *Oxford M. School Gaz.*, 1957, *9*: 70-76 (p. 73).

ROBERTI GROVII

CARMEN

DE

SANGUINIS CIRCUITU,

A

GULIELMO HARVÆO ANGLO,

PRIMUM INVENTO.

Adjecta ſunt,

MISCELLANEA

QUÆDAM.

LONDINI,

Typis R. E. Impenſis Gualteri Kettilby, ad Inſigne Capitis Epiſcopalis in Cœmeterio D. Pauli.

1685.

FIG. 1. Title-page of the 1685 edition of Robert Grove's *Carmen de sanguinis circuitu &c.*

to Grove's poem by Sir D'Arcy Power in the following letter which is in the possession of the Library of the College of Physicians of Philadelphia:[8]

10 A, Chandos Street,
Cavendish Square, W.

Dear Dr. Weir Mitchell,

I am very glad to have a letter from you about Harvey who interests me as much as he does you. Lycisca is an old friend. His name occurs in "Roberti Grovii Carmen De Sanguinis circuitu a Gul[sic] Harvaeo Anglo &c. Lond. 1685. The lines are

"Tu quoque notus eris, totoque in Orbe
Clarus, et aeternum vives moriture Lysica [sic]."

Grove was Bishop of Chichester and was at Oxford when Harvey was at Merton. The poem describes in detail one of Harvey's demonstrations on a dog and is so circumstantial that I have very little doubt the future Bishop saw it.

I have not forgotten Duppa but have not yet had time to look up the original letters which seem to be in Northamptonshire.

I am just now beginning a transcript of Dr. John Ward's Diary. He was Vicar of Stratford on Avon in the middle of the xviith century. Parts have been published but no one seems to have examined the whole of the 16 volumes, so I am getting a fair copy made. It promises to be interesting as Ward was an M. D. as well as a B. D.

With kind regards
I am
Yours very sincerely
D'Arcy Power

Although D'Arcy Power did not refer to this poem in his biography of Harvey (1897), several years later he had occasion to mention it in his Hunterian Oration delivered before the Royal College of Surgeons of England on Saturday, February 14, 1925; this Oration was reprinted in his *Selected Writings, 1877-1930* (Oxford, 1931), and footnote 2, page 27 reads thus:

Robert Grove (1634-96), afterwards Bishop of Chichester, in his *Carmen de Sanguinis Circuitu*, gives a detailed description of Harvey's demonstration of the action of the heart in a living dog. Grove is probably the only bishop of the English Church who actually took part in a vivisection to show the tolerance of the heart to mechanical stimulation.

It is surprising that Weir Mitchell and D'Arcy Power do not appear to have suspected that the future Bishop was perhaps a little young—8 to 12 years old—to have seen Harvey dissect at Oxford during the

[8] S. Weir Mitchell. Miscellaneous letters about Harvey; notes etc. Library of the College of Physicians of Philadelphia (call no. Z10 52).

years 1642-1646. However, it is of course just possible that if Grove had been an exceptionally observant child he might have been taken to Oxford, perhaps by a relative, to see Harvey; and, in later years—and perhaps after referring to *De motu cordis* for technical details—have written the poem, basing it on what might well have been the outstanding memory of his boyhood. As regards the possibility of Grove having seen Harvey dissect *after* the latter's Oxford years, this can be discounted, as Harvey, although he "appears to have preserved his faculties unimpaired to the very last [i. e., 1657]" and to have "continued to deliver his lectures till within a year or two of his death," [6] did not, as far as is known, perform any actual experiments during these last years in London. As Keynes has said, "by . . . 1645, Harvey was aged sixty-eight, and disinclined to enter into practice himself. He was afflicted with gout, his life had been disrupted by the Civil War, and he had lost some of his most treasured possessions. Henceforth his life was to be one of seclusion, spent chiefly in the houses of his brothers in London or at Roehampton, or at Combe in Surrey." [7]

Further, if Grove had actually seen Harvey dissect, it is perhaps fair to assume that he would have referred to this in the preface ("*ad lectorem*") to his poem in which he actually states how the poem came to be written:

> Here you have in a few words, if you care to know, the story of what brought this offspring born of my leisure not of my genius into the light of day. I happened to be walking with a very good friend of mine, an extremely learned man, and we were discoursing, as it were, on various matters. And when he unexpectedly made what amounted to a request that I should compose a Latin poem on the circulation of the blood, discovered by William Harvey, I began to wonder what had come into his head that he should assign anyone a task that, besides being complicated enough in itself, had never before been attempted by anyone, still less by me, since I had never claimed to be numbered among the poets, and had never written anything in that genre except what was forced out of me by my fear of teachers or by the entreaties of friends; and by this time it was over eleven years, I believe, since I had even dreamed of verse composition. I therefore definitely refused at first, but when I gained nothing by my refusal except his even more strenuous insistence, I obeyed him, though almost against my own will, and girded myself for the unusual work. After I had made some slight progress, I realized that I had fallen into straits and shallows. Terrified, then, by the difficulty of the assignment, I put aside the trifling amount that I had produced. It lay nearby me neglected for some

[6] R. Willis, "The Life of William Harvey" in *The Works of William Harvey* (London: The Sydenham Soc., 1847), p. lxxxv.

[7] Geoffrey Keynes, *The Personality of William Harvey* (Cambridge: Univ. Pr., 1949), p. 35.

years; and would have lain there eternally, I think, except that another friend, an outstanding investigator of nature, a great lover of humanistic studies, demanded unyieldingly that I should carry through to the end what I had begun. I was of course already regretting what I had started, but I was finally influenced by his entreaties, and the following winter when I was incapacitated by the quartan fever, and the doctors had forbidden any more serious studies, I finished, bit by bit and as best I could, what I had begun in leisure hours.

After my opening lines, intended to give a clearer explanation of the subject, I introduce the character of Harvey giving a discourse on the circulation of the blood, and touching on those same points which he was later to write about, especially in the *De animalium generatione* [1651]; and I remembered that somewhere he had mentioned the observations made by him on insects and their generation; also that he had complained bitterly that the documents in which these and other descriptions appeared, were lost because of military looting; I therefore seized this opportunity to make him deliver a prophecy on the entire Civil War and the amazing political changes which have taken place before our eyes. Then, after first talking about the arrival of our most happy sovereign in England, he adds some remarks, a little too lengthy, about the Royal Society, established under the auspices of that most noble Charles. It is as if he were delighted by those great increases in natural philosophy. Then he glides back into the subject, the circulation of the blood, as if he had been pushed out of the mainstream temporarily by some current. These and other points are scattered through the work, reader, so that I may at least amuse you by a sort of variety.

I made certain to show this little assignment, finished for better or worse, to a number of men skilled equally in poetry and medicine; and when they found nothing very blameworthy in it, and some in fact thought it worth publishing, I allowed it to appear in public . . . [The remaining few lines of this *ad lectorem* are concerned with some of Grove's other poems which also appeared in the 1685 edition of his Harvey poem].

As regards the poem itself, the descriptions given in it of Harvey's experiments on the dog tally remarkably well with those recorded in *De motu cordis*; Harvey, of course, used dogs, *e. g.*, in writing of the movements of the heart he states that " these things are more obvious in the colder animals . . . [and] . . . also become more distinct in warm-blooded animals, such as the dog . . ." [8] In the poem, Harvey " snatches a dog, binds him with the neck twisted, and lifts him, placing him flat on his back on a table. But the dog is bristling with stiff hair, and he bites at Harvey's arms; he fills everything up with great howls, and he uses his feet in battle." And later on ". . . when the wild beast felt the wound, he twisted his entire body into contortion and howled with a loud, sharp noise; foaming and threatening in vain with eyes and teeth . . . [and] a

[8] William Harvey, *De motu cordis* (London, 1952; Everyman reprint of Willis's translation for the Sydenham Society, 1847), p. 24.

trembling beats at his guts and fiercely he gives his empty, strengthless rage a workout. For, as he strives to rise up with the utmost effort, he is held back by the twisted knots and the beam-nails." Harvey is made to address the dog, and does so at some length (e. g., "It is no savagery of mind, no horrible lust . . . that makes me cruel, nor any ruthlessness of the wild heart, but I have taken into the depths of my mind and all my inner marrow the accursed hunger for praise; this forces me to make such massive plans as these against my will, and it drives the gentle feelings out of my heart . . . Wretched one, though you will suffer unspeakable pains and bear a punishment you do not deserve, at least take this consolation in death: you have not been murdered by any unjust fate, you will not die torn apart by the tooth of some mad Molossan hound, and lazy old age will not finish you off"; and so on, and so forth). In *De motu cordis*, however, Harvey never indulges in such verbal histrionics, and his only remarks about vivisection are concerned more with practical or technical difficulties rather than with ethical implications.

Again, in the poem the effect of placing ligatures around the aorta and the vena cava is colorfully and dramatically described, and the details are essentially similar to those reported far more soberly in *De motu cordis*. Then we have the high spot of the poem—the concept that the blood circulates:

> In the beginning, the blood struggles out from a single source, joins forces, and is carried along in a great current. But later it splits itself into smaller streams. Then entering on to a dark journey and blind channels, it goes through the thin end points of the veins [*Exiles Venarum apices*; Ashhurst also had problems with this part of the translation] and slowly through tiny vessels, looking for greater things. And becoming ever more abundant by its travelling, it returns to the heart as a huge torrent. For, just as wet springs and lesser streams lead their waters into the Thames with a gentle murmering, the Thames itself, the more ample from the new inflow and the widened riverbed, pushes its increasing waters forward in a curving course and attacks the sea with a huge stream; in the same way the blood, returning from this supreme part of the body, first insinuates itself into the thin veins and the small canals; then suddenly it overflows and looks for greater vessels; finally it gathers in its streams from all sides, forces them into the *Cava* and binds them by those same banks. It is heavy and swells, and being distended with the back-flowing fluid, it puts down part of the burden and vomits it onto the shores of the heart. As soon as the heart feels the weight of the incoming fluid, it is bent and stiff; and, becoming weighed down by the additional mass, raises itself up with all its nerves and powerfully exerts great force to grasp and bind the bloody fluid; but the blood rushes out at the open gate: it washes the entire lung and, exhaling a foul smoke from the chest, it dislodges the overly-great heat of that breath of air. Also, by breathing air inwards it rouses the flames of life and is violently kindled with a divine fire. Then the brilliance returns to that which was

exhausted and a new splendor to the fluid. And now it enters the left curve of the heart in greater brilliance. Also, from there, driven by great force, it leaps into the vast aorta which is distended by the stroke, and at the same time all the branches of it pulsate throughout the body. This is the journey of the blood, and the royal highway of life: the blood is driven in endless spirals around all parts of the body, and it continually runs back, now into the veins, now into the heart. It makes the journey and returns and, alternating in a swift seething, the stream is turned around and whirled in its own footsteps. And in its circular flow, it travels all the way through an untiring sphere . . .

What Harvey would have thought of all this, had he lived to read it, is an intriguing thought; he probably would have disliked the torrential verbiage, for here is the rough equivalent of the above passage in *De motu cordis*:

Since all things, both argument and ocular demonstration, show that the blood passes through the lungs and heart by the action of the [auricles and] ventricles, and is sent for distribution to all parts of the body, where it makes its way into the veins and pores of the flesh, and then flows by the veins from the circumference on every side to the centre, from the lesser to the greater veins, and is by them finally discharged into the vena cava and right auricle of the heart, and this in such a quantity or in such a flux and reflux thither by the arteries, hither by the veins, as cannot possibly be supplied by the ingesta, and is much greater than can be required for mere purposes of nutrition; it is absolutely necessary to conclude that the blood in the animal body is impelled in a circle, and is in a state of ceaseless motion; that this is the act or function which the heart performs by means of its pulse; and that it is the sole and only end of the motion and contraction of the heart.[9]

Finally, in the poem Harvey is made to look into the future—he sees the Civil War (this, incidentally, suggests that the Harvey of the poem is of pre-Civil War vintage, and makes it even less likely that this was the Harvey that Grove is thought to have seen), and he sees the formation of the Royal Society. In the Civil War section of the poem there are some unflattering remarks about Cromwell:

What madness of the mind, what great insanity is rousing up our ungrateful British countrymen and hurrying them into fierce battles, though they are overly happy now under the reign of Charles? Ah, what destructions, what riotings are the hostile fates planning? I see fields that are pools of blood, and battle lines of kinsmen red with slaughter on both sides. What does that Parliament want, as it creeps up from the depths of hell? Or that terrible two-edged axe, spattered with royal blood? My prayer is that black death may cover up my heavy eyes before I see the events and the weeping of that day. By what different fates England will be tossed about! First a huge Hydra [the Long Parliament] will lord it over her in her misery. But a fierce serpent [Cromwell] lifts up his obscene head from

[9] *Ibid.*, p. 85.

hell, scattering fearful fires from his flaming eyes, his pale yellow mouth made filthy with drops of blood. And he rushes against that same Hydra and throws her down from her lofty seat, and sends her back to shadowy Tartarus. But he himself soon calls up another Hydra [Cromwell assembles the Barebones Parliament] by night and in the pale shadows; this one he dispatches with a sudden and unexpected wound, and in anger pushes her down to the Stygian waters as she vainly attempts to hiss and coils her feverish head. Then he stands proud with spoils of the gods, and with an ivory throne [Cromwell becomes Protector], and he, the godless one, takes three sceptres away from the scale-bearer's mouth. And now, happy in his new kingdom and his prosperity, he exalts, and in madness carries on orgies in the empty palace . . .

Later on in the poem, when Charles II is safely enthroned, there are some interesting comments about the formation and functions of the Royal Society:

What could not be accomplished by the presence of so great a king? Under his auspices a famous council of learned men is assembled . . . And these men are not indulging in mere trifles or forms that have no sure origin; instead, they carefully deal with the weights of things, and, in their desire for truth, they test each thing completely . . . they leave nothing omitted or untried; everything is investigated. By fortunate examination they discover many things, and they reshape for the better things explored by others . . . They seek out all the tiny filaments and the minute vessels. And if by chance they should surpass my work, then defeat is a joy to me and a thing I love . . .[10]

What of Grove himself? What records are available that might throw further light on the background of his remarkable poem? As regards his life, the *Dictionary of National Biography* gives the following formal account:

Robert Grove (1634-1696), bishop of Chichester, born in London in 1634 or 1635, was the son of William Grove of Morden, Dorsetshire (Burke, *Landed Gentry*, ed. 1868, p. 608). In 1645 he was sent to Winchester College, and was admitted a pensioner of St. John's College, Cambridge, on 18 Oct. 1652 (Kirby, *Winchester Scholars*, p. 182; Mayor, *Admissions to St. John's College*, pt. i. p. 108). He was elected a scholar in 1653, graduated B. A. in 1657, and became a fellow on 23 March 1658. For several years he lived in college as tutor, proceeding M. A. in 1660, B. D. in 1667, and D. D. in 1681. The elegance of his scholarship is evinced by his verses in 'Academiae Cantabrigiensis . . . ,' 1660, and his 'Carmen de Sanguinis Circuitu a Gulielmo Harvaeo primum invento,' published with some miscellaneous poems in 1685. Grove, on becoming chaplain to Henchman, bishop

[10] This sentence and the preceding one suggest that Grove was aware of Malpighi's discovery of the capillaries. Since Malpighi published his capillary studies in 1661 in *De pulmonibus*, this would indicate that Grove wrote this part of the poem in or after that particular year.

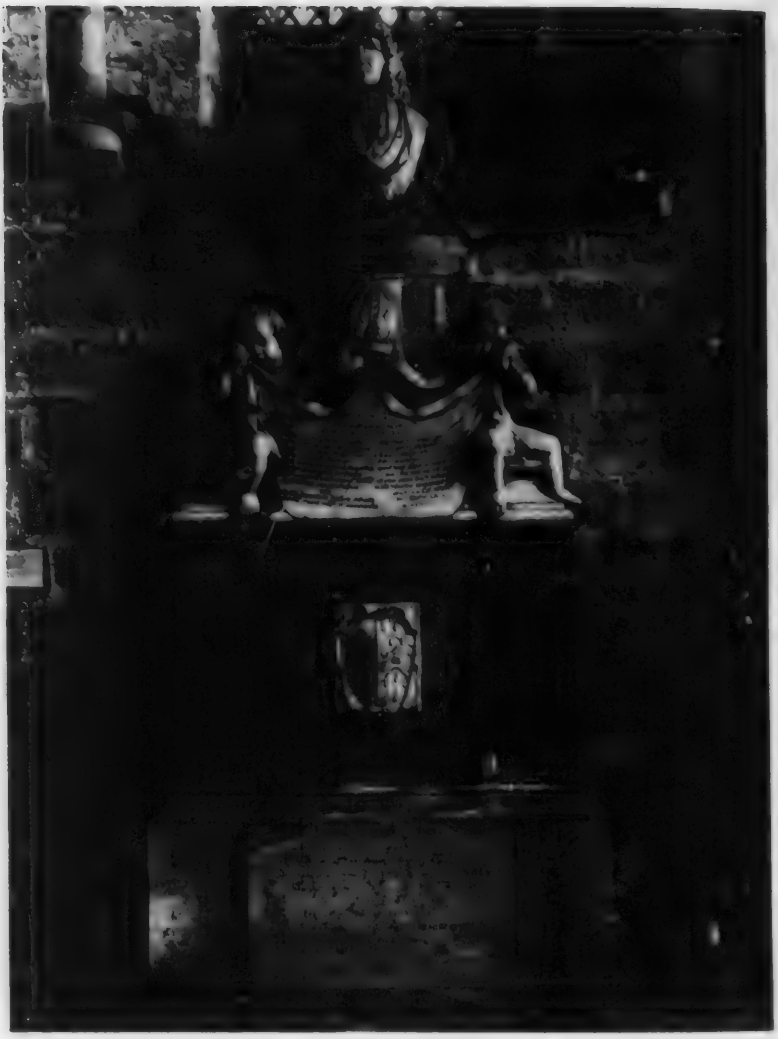

FIG. 2. Contemporary photograph (1954) of Robert Grove's monument in Chichester Cathedral. —*National Buildings Record.*

of London, was presented by him to the rectory of Wennington, Essex, on 21 Feb. 1667, which he left before 27 Jan. 1669. On 2 Sept. 1669 he received from the crown the rectory of Langham, Essex (NEWCOURT, *Repertorium*, ii. 366), and on 5 Oct. following the rectory of Aldham, in the same county, from the bishop (*ib.* ii. 7). These livings he resigned upon obtaining from Henchman the wealthy rectory of St. Andrew Undershaft, London, on 18 Feb. 1670 (*ib.* i. 83, 230, 268). From 1676 to 1689 he maintained a sharp controversy with William Jenkyn (q. v.) and other nonconformist divines. On 6 Oct. 1679 he was made prebendary of Willesden in St. Paul's Cathedral (LE NEVE, *Fasti*, ed. Hardy, ii. 452). He took part in drawing up the famous petition against the king's declaration for liberty of conscience in May 1688. On 8 Sept. 1690 he was appointed archdeacon of Middlesex (*ib.* ii. 331), being also chaplain in ordinary to the king and queen. He was consecrated bishop of Chichester on 30 Aug. 1691 (*ib.* i. 252-3). He died from the effects of a carriage accident on 25 Sept. 1696, aged 62, leaving his family poorly provided for (*Life of H. Prideaux*, pp. 109, 112). He married Elizabeth Cole of Dover. He was buried in Chichester Cathedral (DALLAWAY, *City of Chichester*, p. 137). [This account closes with a list of his writings; a similar list is also given in Wing].

In the British Museum's Landsdowne MS. 987 [containing biographical memoranda from 1665-1717 written by Bishop White Kennett (1660-1728)] there are some "Memoirs of DR. ROBERT GROVE Bishop of Chichester who died in Sept. 1696" from which we learn, as in the account given in the *Dictionary of National Biography*, that he "died of a fall out of his coach upon his horses running away," and that "he left his wife and children unprovided for; the widow supported by charity, and the sons unfortunate tho they met wth. good friends for their fathers sake." Mention is also made in this MS. of his burial in Chichester Cathedral, and of the "neat marble monument supported by weeping angels." This monument is still in the Cathedral (Fig. 2); it was originally on the platform in the retrochoir behind the high altar, but was moved into the cloisters from 1860 until 1890 when it was transferred to its present position in the north transept.[11] The translation of the Latin inscription on Grove's monument is as follows:

Bishop Robert Grove: Formerly of Winchester College, Fellow of St. John's College, Cambridge, Bishop of Chichester. He was born in London; conspicuous in all things for his dignity, but unostentatious: a celebrated defender of the English Church and of the clergy, in elegant language, as well of the Latin as of his mother tongue: happily experienced in confuting and conciliating his opponents: a man of great sagacity, of improved judgment, of facetious wit joined to great modesty: of dignified manners but of easy access to all: compassionate and kind to the poor.

[11] Francis W. Steer (Sussex County Archivist and Chichester Cathedral Librarian). Personal communication.

He died through an unfortunate accident, which sometimes happens to the good as well as to the evil, by a fractured leg: such was the will of God, and he exhibited amidst his pains a great example of patience. He died the 20th of October 1696, aged 62.

That the fame of such a man, of such virtue, may be had in perpetual remembrance and be imitated by posterity, William Bancroft, S. T. P., Treasurer and Canon Residentiary of this Church, desirous of manifesting his gratitude towards a generous patron, has caused this monument to be erected.[18]

Grove is also mentioned *en passant* in John Evelyn's *Diary* (for his sermons); in Clark's edition (1891-1900) of *The Life and Times of Anthony Wood* (for his consecration); and in Anthony Wood's *Athenae Oxonienses* (for some of his writings). No MSS. of Grove are in such obvious places as the British Museum, St. John's College, Cambridge, and the library of Chichester Cathedral.

Recently, on looking through the list of his publications given by Wing, I became interested in No. 2149—" Catalogue of the Library, (London), 27 April 1697." The only copy, according to Wing, was in the British Museum but enquiry there failed to reveal it in the regular catalogue; and it was only after communication with Mr. Wing that I discovered that this item was a sale catalogue and listed in the Printed Catalogue of Sales Catalogues in the Museum Library (Sales Catalogue 891); I recently received a microfilm of this *Catalogue* of the sale of Grove's library. The title-page is as follows:

The Library of the/Right Reverend Father in God/Robert,/late/Lord Bishop of Chichester,/containing/The Councels, Fathers, Ecclesiastical Historians,/the *Greek, Roman, English*, and other Historians; the/Philologers, Poets, Orators and Criticks, of the best/Editions, in *Gr. Lat. Span Ital.* and *French.*/Also his Lordships Collection of *English* Books, in Divinity, History,/and other Faculties in all Volumes./Will be sold by Auction at *Tom's* Coffee-house, adjoyning to *Ludgate*, on *Tuesday*/the 27th instant, and the following days, at Three in the Afternoon./By John Bullord/[device]/Catalogues may be had *gratis* at Mr. *Notts* at the *Post-House* in the *Pall-mall*, Mr. *Bucks*/next the Fountain Tavern in *Fleetstreet*, Mr. *R. Parkers* on the Piazza under the/*Royal Exchange*, and at the place of Sale./

That Grove's books were sold a few months after his death is perhaps not surprising; after all, as has already been mentioned, his wife and children were unprovided for when he died, and to sell his library would be an obvious way to raise some ready money.

[18] *Ibid.*

One might, in view of the preceding comparison of Grove's poem with Harvey's *De motu cordis*, have expected to find a copy of the latter and perhaps a few other medical books in Grove's library. But examination of the contents of the *Catalogue* reveals that Grove possessed, in addition to the sort of theological works one would have expected, an enormous number of medical books. A 1628 *De motu cordis* is listed, and so is the 1648 Rotterdam edition [Keynes 7]; also the 1649 Rotterdam edition of *De circulatione sanguinis* [Keynes 31], and the first edition (1651) of *De generatione animalium*. So much for Harvey; but just about every medical book of note up to the last decade of the seventeenth century is also listed. In the section of the *Catalogue* entitled "Libri Medici, Pharmaceutici, Chirurgici, Anatomici, Chymici, Botannici & Naturalis Historiae" 210 books in folio are listed, 466 in quarto, 586 in octavo, and 211 in duodecimo. This gives a grand total of 1473 books of predominantly medical interest and content; and there are also a few more similar volumes scattered through some of the other sections of the *Catalogue*. A detailed analysis of Grove's medical books is now being prepared, but meantime it may be said that his library must take its place among the great medical collections of the seventeenth century;[18] it is tragic that it had to be sold piecemeal.

We cannot be sure, of course, that Grove personally acquired this wonderful collection; he could, for example, have been given or willed one or more medical libraries. But in view of his keen insight into such technical matters as the circulation of the blood, it is tempting to believe that the medical works in his library were indeed his own.

In conclusion, the interesting question of why one who was destined to become a bishop should have been sufficiently interested in the circulation of the blood to write a poem on this subject, and also, presumably, to have accumulated an enormous medical library, is perhaps worth considering. Nowadays, in an age of dedicated, if not obsessional specialization, the idea of a bishop interesting himself to any great extent in the circulation of the blood borders on the fantastic; and for such a one to write a technical poem about the matter, to say nothing of acquiring some fifteen hundred medical books, would indeed be fantastic. But in the seventeenth century, as Hall has observed, "the typical scientist was a gentleman who, if he was unable to live on his income, entered upon the ministry of religion, the practice of medicine, or the service of the state. By the

[18] *See* e.g., John F. Fulton, *The Great Medical Bibliographers* (Philadelphia: Univ. of Pennsylvania Pr., 1951) for details of some other great libraries of the 17th. century.

standards of a later age he was an amateur and dilettante, unconscious of a deep distinction between science and his many other occupations." [14] Bishop Robert Grove, although neither scientist nor physician, undoubtedly had the breadth of interests characteristic of his times—would that such spirit and such men were commonplace today.

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[14] A. R. Hall, *Ballistics in the Seventeenth Century* (Cambridge: Univ. Pr., 1952), pp. 2-3.

THE CAUSE OF CHOLERA: ASPECTS OF ETIOLOGICAL THOUGHT IN NINETEENTH CENTURY AMERICA*

CHARLES ROSENBERG

Cholera was a new and unavoidable challenge to the medical world of the nineteenth century. At its first appearance in the West, it represented as much a mystery as had the plague five centuries earlier, for the theoretical resources of the average physician in 1832 were not greatly different from those of his medieval predecessor. Yet, by 1866, only thirty-four years after their first experience with cholera, even provincial Americans were familiar with the names of Snow and Pettenkofer, Liebig and Berzelius. Traditional concepts had changed, infiltrated and supplanted by new ideas.

In 1832, when cholera first appeared in this country, American medical men were convinced that it was not contagious. Its cause lay in the atmosphere.[1] Experience with vaccination and smallpox, the one new and extremely pervasive element in etiological thought, served only to reinforce the dominant anti-contagionism. Unable to abandon older ideas, medical thinkers failed to generalize from their experience with vaccination and to assume that a similar, though as yet undiscovered, process might take place in other diseases. Any disease not conforming to the rigid and arbitrary "laws" assigned smallpox could not be contagious.

Nor was it difficult to show by analogy that cholera was not contagious.

*This investigation was carried out during the tenure of a Predoctoral Fellowship from the National Institute of Mental Health, United States Public Health Service.

[1] A sample of the opinions expressed by one hundred and nine American physicians during the years 1832-4 shows that ninety did not consider the disease to be at all contagious, while only five considered it to be primarily contagious. The other fourteen considered the disease to be primarily non-contagious but admitted that under some circumstances it might be communicable (contingent-contagionism). Of the eighty-seven physicians who clearly expressed their opinion as to the actual cause of the disease, forty-eight considered it to be due to some substance added to the atmosphere or some change in its constituents. Others, expressing only their opinion that the disease was an "epidemic," may also be presumed to have believed in its atmospheric transmission, since an "epidemic" disease was usually defined as one spread through the atmosphere. Ten physicians regarded the disease as being caused by some substance of "terrene" origin in the atmosphere. These opinions have been gathered from books, pamphlets, medical journals, newspapers, diaries, letters, and journals. A similar procedure has been followed for the 1849-1854 and 1866 epidemics.

Even if transmitted from place to place, cholera was certainly not passed "from one body to another, or through the medium of those morbid secretions of the human system which preserve and multiply the sources of infection in contagious diseases." Cholera could be contracted more than once, while a contagious disease—defined in terms of smallpox—could not. Moreover, smallpox was not influenced by atmospheric variations as were cholera and other "epidemic" diseases. Regardless of atmospheric conditions, all exposed to its poison would inevitably fall victim unless they had been vaccinated or had recovered from an attack. This was manifestly not the case in cholera. The poison secreted by a person suffering with a contagious disease was specific in character and always caused precisely the same disease. For this to happen, wrote the irascible Charles Caldwell, only part of the time, or only in certain circumstances, would be a change as drastic as the transformation of a rattle snake into a black snake, or aconite to asparagus.[2]

Physicians naturally assumed that cholera was a specific disease. Unlike other ills, it had a specific and "known" cause, one that could be placed in a glass vial and carried to a distant city, there infallibly to produce the same disease. But in this, smallpox was unique. At this time, indeed, the very concept of disease specificity was more than a little suspect. Following Broussais, many American physicians disclaimed belief in what they termed "ontology." ("That is, in the idea that disease is an *entity*—a being—a something added to the system.")[3] Disease was a protean and dynamic condition. Psychic and somatic ills were not rigidly demarcated. The etiology and symptoms of disease were constantly affected by climatic, hygienic, mental, and moral factors.

Even before they had seen the "oriental scourge," some American physicians wrote soothingly that cholera was but another form of "sinking typhus," others that it was a variety of bilious fever or a "Lymphatic Hemorrhage." In the midst of fighting a cholera epidemic, a Philadelphia physician found time to note that he was treating a "malignant congestive

[2] Patrick Macauley: *How is the Cholera Propagated?* . . . (London: Miller, 1831), p. 6; N. Y. C. Board of Health, *Reports of Hospital Physicians and other Documents* . . . ed. by Dudley Atkins (New York, 1832), p. 140; *Boston Recorder*, June 27, 1832; Joseph M. Smith: *Discourse on the Epidemic Cholera* . . . (New York: Seymour, 1831), pp. 24-25; Charles Caldwell, *Maryland M. Recorder*, 1831, *2*: 574.

[3] "On the contrary," he continues, disease "is virtually disorder, an alteration of the natural state or actions of the tissues of organs of the economy." Hugh L. Hodge: "On the pathology and therapeutics of cholera maligna," *Am. J. M. Sc.*, 1833, *12*: 388. Hodge cites Broussais and Bichat and, like most American physicians, seems not to have assimilated the work of those opposed to Broussais.

fever." A rural New York physician cited Rush to lend authority to his classification of cholera as a " suffocated fever." [4]

Most common was the opinion that Asiatic Cholera was only an aggravated form of common cholera—a flexible term used to describe ailments as diverse as dysentery and diarrhea. Comforting in its familiarity, this nomenclature also played another role, implying a local origin for the disease, and hence non-importation and non-contagion. In the words of Daniel Drake, cholera bore " to cholera morbus, a relation similar to that of the influenza to a common cold." It differed only in virulence. One physician reported finding three or four different degrees of cholera in the same family, ranging from the mild common cholera to the malignant. " The common Cholera heightened by panic " seemed less threatening than a completely new and spectacularly fatal ailment.[5]

With " disease " so flexible a concept, it was only natural that mental and moral factors should be presumed to play a role in its causation. Those succumbing to the ubiquitous " epidemic influence " had somehow predisposed themselves, had over-eaten, been intemperate, or had capitulated to panic. Despite the obvious moralism [6] of such injunctions, medical thinkers did not regard the disease as a direct imposition of the Lord. Its onset was an inevitable result of the debilitating physical effect of transgressing His physical and moral laws. An active exercise of faith in God and His justice would protect one from fear and thus from cholera, but, however, " pre-eminently by the physical influence of that faith." For fear has

> a more specific operation upon the human body, than any other passion; it spasmodically contracts the mouths of thousands of our perspiring or exhaling vessels, flings the acrid perspirable matter upon the insides of our digestive organs, which it stimulates, and causes by abstracting much of the watery part of our blood, a looseness and congestion in our bowels, the very proximate cause of the Epidemic Cholera.

Indeed, the entire epidemic might be explained as a mass psychological phenomenon, akin to the " jerks " at a camp meeting. William Beaumont was only expressing a truism of his time, when he wrote that " the Greater

[4] John Esten Cooke: " Remarks on spasmodic cholera," *Transylvania J. Med.*, 1832, *5*: 481-500; Thomas Miner, *Boston M. & S. J.*, 1832, *6*: 397; William Darrach, Diary, MS, Penn. Hist. Soc., Aug. 19, 1832; E. Cutbush, *Western M. Gaz.*, 1833, *1*: 63.

[5] Daniel Drake, *West. J. M. & Phys. Sc.*, 1832, *6*: 79; " Diocles," Washington *National Intelligencer*, Sept. 4, 1832; James McNaughton; *Letter on the Epidemic Cholera of Albany* . . . (Albany, 1832); Ossining, N. Y., *Westchester Herald*, July 10, 1832.

[6] This is discussed at greater length by the author in " The cholera epidemic of 1832 in New York City," *Bull. Hist. Med.*, 1959, *33*: 40-45.

proportional number of deaths in the cholera epidemics are, in my opinion, caused more by fright and presentiment of death than from the fatal tendency of the disease." [7] Even more directly than fear, sexual excess, gluttony, or an improper diet would weaken the " system " and predispose it to cholera.

This doctrine of predisposing causes, however, played more than a monitory role. It reinforced one of the weak spots in the atmospheric theory by explaining how some were stricken while others remained exempt, though all breathed the same atmosphere. Concentrations of cholera cases in circumscribed slum areas might be charged—and were—either to the moral qualities of the victims or to the presence of crowded tenements, decaying filth, resident pigs—anything which might produce miasmata or somehow vitiate the air needed to maintain normal respiration. Only those so weakened would then be attacked by the latent cholera poison in the atmosphere. In another variation of this theory, the cholera poison in the atmosphere did not become virulent unless it combined with locally produced miasmata. Only when " local " and " general " causes acted in concert did cholera break out. Thus was avoided a repetition of the local origin versus importation controversies which had raged so bitterly during yellow fever epidemics.

The sudden and widely scattered outbreak of cholera cases in many areas also implied that cholera was an atmospheric and not a contagious disease. Dr. Kane of Plattsburg, appointed by his community to observe the disease in Montreal, became convinced that it was not contagious, for it had descended in many parts of the city simultaneously, " like a shower of hail." An American physician, observing the disease in Vienna, concluded that its cause must be some alteration of the atmosphere—the only thing which could have affected so many people at the same time. A similar conclusion was reached by Daniel Drake, after observing the disease in Cincinnati.[8]

[7] " Progress of the Indian cholera," *Methodist Magazine*, 1832, *3*: 468-469; C. L. Seeger: *A Lecture on the Epidemic Cholera* . . . (Boston: Wright, 1832), p. 25; Sylvester Graham: *A Lecture on Epidemic Diseases Generally and Particularly the Spasmodic Cholera* . . . (New ed., Boston: Cambell, 1838), p. 29; Jesse S. Meyer: *Life and Letters of Dr. William Beaumont* (St. Louis: Mosby, 1912), pp. 142-143; Local newspapers, seemingly without exception, printed admonitions warning of the effects of fear and panic.

[8] New York *Evangelist*, June 30, 1832; Charles T. Jackson: " Cholera in Vienna," *Boston M. Magazine*, 1832-3, *1*: 214; Cincinnati *Chronicle*, Oct. 13, 1832. Compare the typical shift of the Albany Board of Health from cautious support of quarantine to violent anti-contagionism after the quarantine had proved unavailing, and the disease had broken out in Albany. Albany *Argus*, June 19, July 10, 1832.

There were but few to question.[9] The atmospheric theory was too convenient. Flexible and amorphous enough to explain the varied phenomena of the disease, it served also as an effective weapon against the "anti-social" and "antiquated" doctrine of contagion. The more precise attributed the disease either to some change in the normal constituents of the atmosphere, or the addition to it of some deleterious substance of terrestrial origin. A greater number found such intellectual refinement unnecessary, content to intone such phrases as "epidemic influence," "choleraic distemperature," or "uncontrollable atmospheric peculiarity."

Although they might disagree as to the nature of this epidemic influence, all physicians could testify to having observed occurrences that only an atmospheric disease could have produced. Outbreaks of cholera were foreshadowed by a "universal tendency toward bowel complaints." When the epidemic began, it "drove out all other diseases" or made them "assume its livery."[10] A St. Louis newspaper noted during a cholera epidemic that there was "scarcely any other disease in the city—all others determining in cholera." An observer in New York reported that there were few cases of any other disease, though all the inhabitants were afflicted with some of the symptoms, which "in proper subjects amount to actual cholera." Even the lower animals were said to succumb to this pervasive atmospheric contamination.[11]

Though the "common people" might regard all diseases as contagious, many of the educated shared the physician's belief that the cause of cholera lay in the atmosphere. Joel Munsell protested to his diary that it was fruitless to burn pitch in an attempt to purify "a boundless element of the noxious particles floating in it." Though not contracting the disease, many laymen noted that their health was affected adversely by exposure to a "cholera atmosphere." Public-spirited newspaper editors, wishing to

[9] It was hard to admit that "we are still wandering in a mazy labyrinth; blind and without a leader," and to criticize the "stale resort of reference to the occult, unknown, and unascertained qualities of the atmosphere. This last, this dernier resort, although it has the authority of Sydenham, is in truth, and in fact nothing more than a confession of ignorance, total ignorance!" Joseph Comstock: "Remarks on the cause of epidemics," *Boston M. & S. J.*, 1832, *6*: 149-159. In a sample of over a hundred physicians, however, only one other physician criticized the atmospheric theory as such. Henry Bronson: "The chlorides and chlorine . . . Preventives of cholera," *Ibid.*, 1832, *7*: 85-94.

[10] In other words, the epidemic influence so dominated the atmosphere that the symptoms of other ills were altered so as to resemble those of cholera.

[11] St. Louis *Missouri Republican*, July 12, 1833; Dr. Isaac Hartshorne, New Haven *Palladium*, July 21, 1832; J. Mauran, S. H. Tobey and T. H. Webb: *Remarks on the Cholera, embracing Facts and Observations Collected at New York* . . . (Providence: Marshall, 1832), pp. 26-27.

scotch the anti-social idea of contagion, filled their columns with expositions of the atmospheric theory, "made clear to the meanest capacity." Stories were circulated, telling of a piece of "fresh, wholesome beef," placed on the Cathedral spire in Montreal, "and taken down after an hour and twenty minutes in a tainted and corrupt state." [12]

Perhaps the most compelling reason for the dominance of the atmospheric theory was the absence of alternatives. The animalcular theory—subject of so much historical interest—was, in effect, a variation of standard atmospheric ideas, differing in that the cholera causing substance in the air was specified as being a "small winged insect not visible to the naked eye." Daniel Drake, the only physician to hold this view in a sample of over one hundred, conceived of the animalculae as "poisonous, invisible, aerial insects, of the same or similar habits with the gnat." This theory which did recognize a need for assuming some specific material cause for disease and which did suggest that it might be organic, found few converts. It was a notion with "but few enlightened advocates," though it was more popular outside of medical circles. Finding few scientific backers, "the little, infernal, greedy, choleric *critters*," became easy prey for the wit of journalistic sophisticates.[13]

Other variants of the atmospheric theory attracted even less interest. At least one physician suggested that some deficiency in atmospheric electricity might be the cause of the disease, but this idea was not treated seriously. Nor was the belief that the disease might be due to some lack of oxygen in the air. The hoary view that epidemics might be caused by the vagaries of extra-terrestrial bodies was held by at least two physicians. (Samuel Cartwright felt that the cause of the disease was a "moving non-electric meteor," while another physician suggested that "the approach of comets to the earth is a great link in the chain of their causation.") Yet even this early in the century, such ideas, "so utterly repugnant to the established principles of physical science," were generally scouted.[14]

[12] Joel Munsell, Diary, MS, NYHS, July 10, 1832; Charles G. Finney: *Memoirs* (New York: Barnes, 1876), p. 320; J. G. Birney, Huntsville, to Ralph S. Gurley, Washington, June 29, 1833, in *Letters of James Gillespie Birney* . . . (New York: D. Appleton-Century, 1938, 2 vols.), vol. I, p. 77; William Lyon MacKenzie: *Sketches of Canada and the United States* (London: Wilson, 1833), p. 235.

[13] S. Clairsville, Ohio *National Historian*, June 30, 1832; Daniel Drake: *A Practical Treatise on the History, Prevention, and Treatment of Epidemic Cholera* (Cincinnati: Corey and Fairbank, 1832), p. 44; Benjamin Lundy: *Life, Travels, and Opinions* . . . (Philadelphia: Parrish, 1847), pp. 32-33; New York *Constellation*, Aug. 11, 1832.

[14] Samuel Cartwright: *Some Account of the Asiatic Cholera* . . . (Natchez, 1832).

Contagionism, though handicapped by being defined in terms of smallpox, seemed the only serious alternative to the atmospheric theory. Lacking the physician's theoretical knowledge, many intelligent and articulate lay observers, in common with ordinary folk, were impressed by evidences of contagion. Charles Francis Adams noted in his diary that the disease followed the tracks of commerce, which "would seem to sustain the doctrine of contagion." To canny old Deborah Logan, "contagion was too apparent to be doubted." In nine cases out of ten, the outbreak of cholera in a community could be traced to emigrants or to communication with an infected city. To some physicians, the opinion that contagion "under certain circumstances, belongs properly to every malignant disease," was not an extreme one.[15] Nevertheless, only one physician in my sample could be considered a consistent and thoroughgoing contagionist.

Bernard Byrne, in a short treatise on cholera published in 1833, argued that cholera, like smallpox, was caused by an "animal poison" and was always contagious. Other diseases, "accidental" and not "specific," were caused not by a poison, but by anything else which might disturb the "system." This theoretical argument was reinforced by an intelligent analysis of the peregrinations of the disease. Whenever, he noted, we see a disease leave its place of origin, we have *prima facie* evidence of its contagiousness; "for in the present state of our knowledge, there is no other mode, than that of human intercourse, by which progress of any disease can be accounted for." If there was such a thing as an epidemic constitution of the atmosphere, how could we account for cholera and yellow fever having prevailed at the same time? Which was the "epidemic"? Was it not a strange coincidence that a disease of local origin should originate in a place where immigration was greater than any other, "and that too at the critical moment when an infected vessel arrived there?"[16]

Byrne, almost alone in his belief, could be ignored. The more numerous

p. 8; J. A. Allen: "Remarks on the etiology and character of epidemics," *Boston M. & S. J.*, 1832, *7*: 55; "A. C." offers this criticism in the Boston *Christian Watchman*, Oct. 12, 1832, a Baptist paper.

[15] Charles Francis Adams, Diary, Adams Papers, Microfilm, Reel 61, June 24, 1832; Deborah Norris Logan, Diary, MS, Penn. Hist. Soc., Aug. 4, 1832; Thomas Miner: "Case of malignant cholera," *Boston M. Magazine*, 1832-3, *1*: 161.

[16] Bernard M. Byrne: *An Essay to Prove the Contagious Character of Malignant Cholera* . . . (Baltimore: Carey, Hart, 1833), pp. 3-4, 7, 9, 59 and *passim*. A representative review termed this treatise "specious" but "interesting." *Boston M. Magazine*, 1833-4, *2*: 393-395.

contingent contagionists had to be answered. On the face of it, they were admonished, belief in a second cause, when one was sufficient, was "unphilosophical" and reeked of "empiricism." Dr. S. H. Pennington, for example, reporting on a group of cholera cases at Whippany, New Jersey, stated that though he could not explain them on any basis other than contagion, he could not consider cholera contagious, for he had seen instances where it had not spread by contagion, and it was "unphilosophical" to suppose that there were more causes responsible for a given effect than are absolutely necessary.[17]

American physicians were still thinking in scholastic terms, hoping by elaborate chains of reasoning to discover the true philosophy of a disease. (Thus high value was placed upon the word "philosophical" and a correspondingly low evaluation given the word "empirical.") Certainly this kind of reasoning, formal in its rhetoric, based perhaps on a random observation, recalled the eighteenth century rather than prefigured the second half of the nineteenth.[18]

When, seventeen years after its first appearance on this continent, cholera next returned, the etiological thinking of most American physicians had not greatly changed. A significant minority,[19] however, were be-

[17] S. H. Pennington: "Report for the eastern district," M. Soc. N. J., *Tr.*, 1833, p. 308. Dr. Pennington, who could not believe the evidence of his own senses, is only an extreme example of this very common view.

[18] Social status was also bound up with education and the formal reasoning which was its symbol. For some of the very few criticisms of this kind of reasoning, see *Boston M. & S. J.*, 1832, *6*: 338; Alfred Woodward: *Information for the People on Cholera . . .* (Philadelphia: Griggs & Dickinson, 1832), p. 12; Richard Sexton: "Remarks on malignant cholera," *North-Am. Arch. M. S. Sc.*, 1835, *2*: 325.

[19] One hundred and three out of one hundred and forty-six medical men whose opinions were sampled, considered the disease to be non-contagious. Twenty-three considered it to be primarily contagious, while twenty were contingent-contagionists. A representative position was that taken by the St. Louis Medical Society, when it voted twenty-six to ten against contagionism. Prairie du Chien *Patriot*, Aug. 13, 1851, cited in Peter T. Harstad: "Sickness and disease on the Wisconsin frontier," (Master's Thesis, Univ. of Wisconsin, 1959), p. 55.

Of the one hundred and forty-six opinions tabulated, thirty-three were unclassifiable. Thirty-five favored some atmospheric influence, while sixteen held a miasma responsible for causing the disease. Seven favored a deficiency—or excess—of electricity in the atmosphere. Four physicians considered a lack of oxygen—or an excess of nitrogen—to be the cause. Five held fungi or animalculi responsible, while three attributed it to a "specific animal poison." Four doctors considered microscopic "germs" to be the cause of the disease. Other theories attributed cholera to an excess of carbonic acid or limestone, to an "Act of God," or to an improper diet. Both in England and in France, anti-contagionism continued to be dominant.

coming aware that to provide a name for a thing was not to understand it. Chemistry and biology had, moreover, provided new alternatives to older ideas. The work of Bassi, Ehrenberg, Schönlein, Cagniard Latour, Berzelius, and especially Liebig, was known, even if in an attenuated form.

Advances in clinical medicine and pathology had also begun to exert an important influence, making respectable the idea of disease specificity.[20] The Americans who had studied in the Paris clinics in the 1830's were the teachers of a new generation of medical students. In addition, personal experience with so striking a disease as cholera had convinced many of its specificity during the first cholera pandemic. In the words of Sir Thomas Watson: "The malady was too striking, to be overlooked, or ever forgotten, by any who had once seen it." John W. Francis had written in the midst of the cholera epidemic of 1832 in New York City, that "nosology [could] not classify a more distinctive disease."[21] By 1849, most physicians agreed that cholera was a specific disease caused by a specific poison.

Certainly, those who had abandoned or attempted to give precision to the atmospheric theory, found it entirely natural to assume that cholera was a specific disease. A specific cause would produce a specific effect—a vague "epidemic influence" would produce effects equally amorphous. For example, a medical man who considered disease to be caused by a fungus would naturally argue that measles always produces measles and smallpox always produces smallpox, "as wheat produces wheat, and rye produces rye; each after its kind."[22]

Still, ideas of specificity were hardly rigid: to many, the variability of disease remained an article of faith. It was difficult to believe that disease could remain the same, while social, even geological and climatic, conditions were changing: "Constitutions, and habits of life, and modes of living are constantly changing; hence new diseases are making their appearance from time to time, while others have vanished from the world." When threatened by cholera, doctors were still urged to study "the ante-

[20] Specificity in therapy still bore the stigma of quackery, however. For an excellent survey of advances in clinical medicine in this period, see Knud Faber: *Nosography* (2nd ed. rev., New York: Hoeber, 1930).

[21] Sir Thomas Watson: *Lectures on the Principles and Practice of Physic* (Philadelphia: Lea and Blanchard, 1844), p. 718; J. W. Francis, *Letter on the Cholera . . .* (New York: P. G. Scott & Co., 1832), p. 32; Robert W. Haxhall, Richmond, Va., *Constitutional Whig*, July 31, 1832.

[22] W. C. Wallace: "Practical and theoretical reasons for the necessity of cleanliness . . .," *New York M. Gaz. and J. Health*, 1854, *5*: 389.

cedents to its approach, its aspect on first manifesting itself, its associations with other forms of disease, its absorption into itself of its Typhoid predecessors, and its final immersion into Dysentery and an Asthenic form of Fever." Many observers noted influenza and intestinal disorders heralding its arrival. Where it raged, cholera was charged with having postponed births. And, as President Polk was warned by a physician, "all diseases of the bowels had a tendency to run into cholera when that disease prevailed." Particularly bad environmental conditions might, of themselves, give rise to "sporadic cholera." Though sporadic cases might arise in such places as the holds of emigrant ships, they would not spread as an epidemic unless the peculiar "epidemic influence" was also present. This belief was extremely pervasive, reflecting a growing concern with environmental sanitation.[23]

Naturally, the socially useful doctrine of predisposing causes was still preached. Journalists, ministers, and others of the public spirited, as well as physicians, published long catalogues of the disreputable actions which might lead to cholera. Newspaper readers were urged to "have peace with God, through the Lord Jesus Christ," for "your peace will be of essential service in enabling you to throw off the malady." The doctrine of predisposing causes was completely unquestioned by the medical profession. Even the moderate report of the American Medical Association's Committee on Practical Medicine and Epidemics reasoned that cholera could not be contagious, for a debauch or a drinking bout had never caused a *contagious* disease.[24]

The great majority of physicians still believed that the cause of cholera lay in the atmosphere. But now the mere profession of this belief seemed inadequate. Believers had to be more precise: they could no longer rely exclusively on affirmation and intonation, but must attempt to define whatever it was in the atmosphere that caused the disease. The number of physicians content to assign the disease to an "epidemic influence," or an "imponderable atmospheric peculiarity," decreased markedly. Now, one blamed the disease upon electricity, or ozone, or carbonic acid, or at

[23] W. Taylor: "Changeability of disease," Med. Assoc. State of Alabama, *Proceedings*, 1852, pp. 68-71; Z. Pitcher: "The cholera of 1854 in Detroit," *Peninsular J. Med. & Collateral Sc.*, 1854, *2*: 145; New York *Day-Book*, Dec. 5, 1848; George Mendenhall: "An account of cholera as it appeared in Cincinnati during the year 1850," *Tr. A. M. A.*, 1851, *4*: 191; Washington *National Era*, Dec. 14, 1848; *The Diary of James K. Polk* . . . ed. Milo M. Quaife (Chicago: McClurg, 1910, 4 vols.), vol. IV, p. 142.

[24] New York *Evangelist*, June 14, 1849; "Report of the Committee on Practical Medicine and Epidemics," *Tr. A. M. A.*, 1850, *3*: 127-129. The report is signed by J. K. Mitchell, R. La Roche, and Francis West.

least a "specific aeriform poison." Local exciting causes continued, however, to play a prominent role in etiological thinking. To a generation increasingly conscious of the relation between disease and environment, local filth and lack of ventilation and pure water were the obvious reasons for the concentration of cholera cases among the poor and in circumscribed slum areas.

Other, older patterns of thought endured as well. Few questioned the assumption that an epidemic disease drove out other diseases or made them "wear its livery." (Epidemics, "seem ever to exercise upon the atmosphere a controlling power, as exemplified in the fact that the ordinary diseases of the country partake in some measure, of the character of the prevailing epidemic.") When cholera was epidemic, ran a popular saying, all other diseases disappeared. One newspaper editor encouraged his readers by noting that rather than increasing during a cholera epidemic, the bills of mortality were less crowded than usual.[25]

As was not the case in 1832, however, a few critics appeared. The Philadelphia Board of Health proved, by comparing mortality statistics for the years 1846 through 1849, that cholera had not driven out other diseases, but that these had on the contrary, increased during the cholera year. Observers in New Orleans and Brooklyn also noted that cholera did not swallow up other diseases or force them to wear its livery.[26] Moreover, fundamental criticisms of the atmospheric theory itself became more frequent.

Alexander Stevens, president of the New York State Medical Association in 1849 and a believer in the atmospheric origin of cholera in 1832, could now call that theory only an excuse for thought: "It is improperly called an explanation. It is only a confession of ignorance; and just as strong proof might be adduced that diseases were induced by witchcraft, or the influence of comets and fiery dragons in the heavens;

[25] Frank A. Ramsey: Cholera (Knoxville: Helms, 1849), p. 2; W. H. Scoby: "Remarks on the influence of cholera on other diseases," *West. Lancet*, 1850, *11*: 91-93; John Butterfield, *Ohio M. & S. J.*, 1849, *1*: 576; A. G. Lawton: "On the epidemic cholera," *Am. M. Monthly*, 1855, *3*: 182; Philadelphia *American Model Courier*, June 16, 1849; Boston *Christian Register*, Aug. 11, 1849. In the east, and in large cities, such ideas were no longer entertained with such assurance by physicians. For example, the four medical men cited above hail, respectively, from Knoxville, Tennessee, Rossville, Ohio, Columbus, Ohio, and La Salle, Illinois.

[26] Philadelphia, Board of Health, *Statistics of Cholera* . . . (Philadelphia, 1849), p. 47; The use of statistics, typical of such reports in 1849, was almost unknown in 1832. Lunsford P. Yandell, *West. J. Med.*, 1849, *3*: 143; Joseph C. Hutchinson: "History and observations of asiatic cholera in Brooklyn, N. Y., in 1854," *New York J. Med.*, 1855, s. 2, *14*: 52-53.

. . . it should be discarded from science; it belongs in the middle ages." John Evans, editor of the *Northwestern Medical and Surgical Journal*, charged the atmosphere with being " made the scape-goat to bear off the sins of our ignorance." What evidence, he continued, had ever been presented for this theory other than the fact that everyone contracts cholera while breathing? One might as well blame the stars or the moon for having caused the disease.[27]

The rhetoric of progress could cut two ways, however, and the anti-contagionists were the ones who employed it most frequently in their attacks on quarantine regulations. The quarantine implied by a belief in contagionism were regarded with some ambivalence even by contagionists, while their opponents labelled them inhuman " relicts of superstition and barbarism." It seemed a mystery indeed, " that this absurd system [was] still maintained, in spite of all sense, science and experience." The abolition of quarantines marked triumphs " of truth over error, not only for the honor of the human mind, but for the benefits of commerce; and above all for the good of humanity." [28]

Some modifications did appear in the arguments which had been so effective in fighting contagionism two decades earlier. Contingent-contagionism could no longer be dismissed as " unphilosophical." Arguments based on analogies with smallpox did not cease, but were vigorously criticized and less frequently utilized. Jonathan Knight, Professor at Yale Medical School, held that such arguments by analogy were responsible for " more errors in reasoning " than had arisen from all other sources.[29]

> It is because we continually try to study one disease by looking at another, that we so often run astray. One specific disease can furnish us no data from which to judge of the nature of another. It is because cholera is a specific disease, and

[27] Stevens: " On the communicability of asiatic cholera," *Tr. M. Soc. New York*, 1850, p. 33; *North-West, M. & S. J.*, 1849, *2*: 278.

[28] *St. Louis M. & S. J.*, 1851, 9: 418; New Orleans *Bulletin*, June 16, 1849; New Orleans *Daily Picayune*, Nov. 15, 1848; Henry G. Clark: *Superiority of Sanitary Measures over Quarantines* . . . (Boston: Thurston, Torry and Emerson, 1852), pp. 25-26. Professor E. H. Ackerknecht has connected this anti-contagionism and hostility to quarantine with the growing political and scientific liberalism of the first half of the century. " Anti-contagionism between 1821 and 1867," *Bull. Hist. Med.*, 1948, *22*: 567. Cf. also, *Idem, Rudolf Virchow* (Madison: Univ. of Wisconsin Press, 1953) and J. M. D. Olmsted: *François Magendie* . . . (New York: Schuman's, 1944). Much of the feeling against quarantine in the United States can also be charged directly to the influence of the merchants. Cf. Charleston *Courier*, June 30, 1849.

[29] Knight: *An Introductory Lecture to the Course of 1849-50* . . . *On the Propagation of Communicable Diseases* (New Haven: Hamlen, 1849), p. 11; *North-West. M. & S. J.*, 1849, *2*: 278.

differs from any other, that it needs to be studied by actual observation, not by comparisons . . .

By 1849, the idea that cholera was " portable," though not contagious, seemed a moderate one, consistent with the great bulk of evidence. Even decided anti-contagionists had to account for this portability. (As early as 1836, Sir Thomas Watson had concluded that the disease must be portable and could be transported from place to place by persons " who were themselves proof against its effects.") Especially in rural and isolated communities in the United States, the circumstances surrounding cholera outbreaks pointed unmistakably to its having been imported from infected areas.[80]

Nevertheless, there were anomalies in the spread of this " portable " disease not easily explained by believers in either the contagionist or atmospheric theories. Fortunately, the natural sciences had provided new alternatives. One, stemming from microscopy and biology, visualized a microorganism, either plant or animal, as causing the disease. The second, originating in the work of chemists on catalysis and fermentation, conceived of the epidemic as a kind of delayed chemical reaction, taking place either in the atmosphere or the patient's body and caused by the introduction of a small portion of cholera ferment or catalyst.

The idea that microscopic organisms might be the cause of disease was a novel, but not entirely new, one to American medical thinkers in 1849. As early as 1836, John L. Riddell, Adjunct Professor of Chemistry at the Cincinnati Medical College,[81] had outlined at some length a theory in which diseases were caused by " corpuscles," " trans-microscopic " in size, and holding " nearly the same grade in respect to animate and sentient beings which the more simple and minute of the *Fungi* and *Algae* do to the more perfect tribe of vegetables." The cause of cholera must, he reasoned, be organic, for only in living organisms is found the ability to reproduce indefinitely. Chemical reactions are self-limiting, and take place in definite proportions. The unpleasant ulcer caused by the application of caustic potash to the skin could not possibly be communicated to another person.

[80] This was the position taken by the AMA Committee on Practical Medicine and Epidemics. *Tr. A.M.A.*, 1850, *3*: 105-133. Both Samuel Smith Purple and Valentine Mott held similar views. Mott: *An Inaugural Address Delivered Before the New-York Academy of Medicine* . . . (New York: Ludwig, 1849), Purple, *New York J. Med.*, 1849, s. 2, *2*: 252-254; Watson: *Lectures*, p. 719; D. P. Holloway, Richmond, Indiana, to Caleb Smith, Washington, Aug. 4, 1849, Caleb B. Smith Papers, Library of Congress.

[81] " Memoir on the nature of miasm and contagion," *West. J. M. & Phys. Sc.*, 1835, *9*: 401-412; 526-532.

In the fall of 1849, readers of the Philadelphia *Medical Examiner*[21] would have come across an editorial marshalling the evidence for the idea that a micro-organism was the cause of cholera. Reference was made to the work of Bassi and Balsamo, Schönlein and Henle, and even to Boehm, who as early as 1832 had found microscopic fungi in the dejecta of cholera patients. The editorial concluded with a notice of the recent writings of Dr. William Budd. The English physician had, it seemed, adopted the fungoid theory and urged that all cholera evacuations be placed in a chemical fluid known to be fatal to the "fungous tribe." Water should be supplied from uninfected districts, he also counselled, for it was "the principal channel through which this poison finds its way into the human body."

The fungous or cryptogamous theory was, in the United States, identified with the name of John Kearsley Mitchell. A professor at Jefferson Medical College, Mitchell concluded that cholera and other diseases were, in all probability, caused by a fungus, the spores of which could be wafted from place to place in the atmosphere.[22] Others, willing to make the assumption that the cause of the disease was organic and capable of reproduction by "germs," could not, like Mitchell, assume these "germs" to be fungi. Some considered "infusoria" or "animalculae" the cause, while others were willing to admit anything other than that the cause was "specific, reproductive, and infectious."

A growing interest in microscopy, followed by the discover of animalculae and fungi in cholera evacuations, naturally suggested that they might be the cause of the disease. Interest was shown in this work by a number of American physicians. Some, like Waldo Burnett and D. H. Storer of Boston, did not regard the "vibriones" they saw as being peculiar to cholera, while at least one Cincinnati microscopist, W. H. Mussey, felt that he had seen the organisms responsible for cholera. This work, incomplete and fragmentary though it was, promised much for the future. The

[21] 1849, *5*: 685-688.

[22] *On the Cryptogamous Origin of Malarious and Epidemic Fevers* (Philadelphia: Lea and Blanchard, 1849). Mitchell states that he has taught such doctrines for years (p. iii). Though he cites Bassi and others for their work on fungous diseases, he remarks that his ignorance of German has prevented him "from knowing how far the authors of that country, Henle, Muller [sic], and others, have carried their ideas." (p. iv).

Theories similar to those of Mitchell, and based on microscopic observation of cholera stools, were advanced in England during the 1849 epidemic and created a furor both in England and the United States. These reports were finally discountenanced by a committee of the College of Physicians, which reported that the microscopic organisms discovered in the evacuations of cholera patients were not specific for the disease.

significance of a general acceptance of a "germ theory" was not lost on all physicians. In the prophetic words of one: "If such a theory should eventually be proved to be founded on facts, the hypothetical etiology of medical philosophers will be discarded, and medicine be rescued from much of the obloquy which now attaches to it." [34]

The most prominent and consistent of believers in this proto-germ theory was Samuel Henry Dickson, Professor of the Practice of Medicine at New York University. A firm believer in the contagiousness of cholera since 1832,[35] Dickson had, in the interim, been supplied with the theoretical arguments to bolster his position. He had become convinced that the cause of the disease, though "ultra-microscopic," must be living matter: "Whether simply cellular or of complicated structure, whether a fungous sporule or an animalcule, its capacity of self-multiplication, of infinite reproduction, necessarily implies its vitality." Though not certain of their exact nature, Dickson confidently suggested a procedure by which micro-organisms could be proven to cause disease.[36] "A *contagious cell*," was one found only in the animal body when a particular disease was present and which then regularly produced the disease when introduced into the body of another person. Though none of the causative organisms of the great epidemic diseases had as yet been found, Dickson was positive that their nidus was the human body. In a public lecture in New York, Dickson urged rigid quarantines. Their very laxity in the past, he argued, was reason enough for their failure. Moreover, he continued, it was senseless to argue that contagionism was anti-social. It was much less likely to produce a panic than the vague idea of some mysterious epidemic influence pervading the atmosphere.[37]

However, even those firm in the belief that cholera was caused by a micro-organism could not free themselves completely from the complex of ideas which had dominated epidemiological thought for so many centuries. For example, with the conflict over spontaneous generation as

[34] Robert Southgate: "Medical sketch of West Point, N. Y., during the summer of 1849," *New York J. Med.*, 1850, s. 2, *4*: 188.

[35] Dickson, "On the Communicability of the Cholera," *Am. J. M. Sc.*, 1833, *13*: 359-366. He was convinced of the contagiosity of the disease after witnessing an outbreak at isolated Folly Island near Charleston, where the disease had, to him, obviously been brought by a beached emigrant ship on which the disease had been raging.

[36] "On contagion," *Am. J. M. Sc.*, 1849, *18*: 107-118. It is not clear from Dickson's writings whether he had read Henle. Experience with vaccination may have also been a source of his ideas.

[37] The lecture was reported in the New York *Independent*, Dec. 28, 1848. Dickson was, of course, the recipient of much criticism for espousing so "anti-social" a doctrine. Cf. Charles B. Coventry: *Epidemic Cholera* . . . (Buffalo: Derby, 1849), p. 38.

yet unsettled, there was no real necessity to assume that a disease could not originate *de novo* as a result of peculiar local conditions. Even S. H. Dickson assumed that many diseases originated spontaneously. Certainly typhus, " which none will doubt to be generated by filth and want of air, and low living," was one. Other physicians who might agree with Dickson in his supposition that the cause of cholera was organic and microscopic, could not agree that its nidus was the human body, could not forsake completely the older atmospheric and local origin theories. Most physicians who believed that a fungus was the cause of the disease, still maintained a belief in these traditional concepts by assuming that the seeds of the disease were spread through the atmosphere, " germinating " only in those places where conditions were appropriate.[88]

Most members of the medical profession, however, still regarded the fungoid and animalcular theories as unproven, if not bizarre. Austin Flint lamented J. K. Mitchell's treatise on the fungoid origin of the disease, for the " author had identified himself with a fanciful hypothesis, which would only serve as a fresh occasion for sarcasm for those who search the annals of medical literature for subjects of ridicule or reproach." The very idea of looking " for an ague in a mushroom, and for a pestilence in a crop of cryptogamous plants " was absurd. Joseph Leidy, the eminent botanist, ridiculed the idea that there could be spores or animalcula in the atmosphere too small to be detected. " It is," he said, " only saying in other words that such spores and animalcula are liquid and dissolved in the air, or in a condition of chemical solution." [89]

An " animalcular " theory was also popular with the public, which failed, however, to distinguish these newer ideas from traditional ones. Animalcula were still minute insects, just a bit too small to be seen by the naked eye. Xavier Chabert, one of the most spectacular and successful of quacks, and certainly conscious of what people were prepared to believe, wrote that the " aerial cholera poison " was a " small green insect, invisible to the naked eye, but easily to be seen under the action of a powerful microscope." Many physicians, as well, were unable to make a clear distinction. Witness an Army surgeon, who supported a belief in

[88] Dickson: " On contagion," *Am. J. M. Sc.*, 1849, *18*: 107; William Hort: " Remarks on cholera," *New Orleans M. & S. J.*, 1849, *6*: 297; A. B. Palmer, *North-West. M. & S. J.*, 1849, *2*: 362.

[89] Flint, *Buffalo M. J. & Monthly Rev.*, 1849, *5*: 60; Theodore S. Bell: " Cholera," *Western J. Med. & Surg.*, 1849, *3*: 315; Leidy, " A flora and fauna within living animals," *Smithsonian Contributions to Knowledge* (Washington, 1853), vol. V, p. 15; Columbus *Ohio State J.*, June 15, 1849; Thomas D. Mitchell: *Lecture on the Epidemic Cholera* . . . (Philadelphia: Craig and Young, 1849), p. 4.

the cryptogamous theory" by mentioning that during the prevalence of cholera in San Antonio, the atmosphere some miles distant, "was filled with *grasshoppers*, visible to the naked eye." [40]

Far more pervasive than the fungoid or animalcular theories, was the idea that cholera was caused by a "ferment." [41] Accepted wholeheartedly by only a minority of physicians, this theory nevertheless found a place in the ideas of many others. On what other basis, besides that of personal contagion, could the portability of the disease be explained? (One need only assume that a minute quantity of the "cholera ferment" had been somehow introduced into a receptive environment.) The atmospheric theory need not be discarded, for it seemed probable that this "fermentation" process took place in the atmosphere.[42] The same theory might also explain how local nuisances fostered cholera. A deadly miasma might well be produced by fermentation in the filth, offal, and confined air of the slums. Not inherently inconsistent with older ideas, it served to clothe them with the scientific garb necessary in a more critical generation. Nor was the fermentation theory inconsistent with the idea that cholera was caused by a micro-organism. It was logical to suppose that the ferment might be organic in nature. Only a "nucleated cell" with its indefinite powers of reproduction could "leaven" whole continents.[43]

New and promising elements were clearly apparent in American etiological thought in 1866, as the United States faced an epidemic of Asiatic Cholera for the first time in a dozen years. "Exact methods of investigation," used during the epidemics of 1849 and 1854, had shown that the poison responsible for the disease was propagated "in the diarrhoeal

[40] J. X. Chabert: *Observations on the Origin, Treatment and Cure of Asiatic Cholera . . .* (New York: Marks, 1852); J. B. Wright: "Report on the topography of San Antonio, and the epidemic cholera that prevailed there in the spring of 1849," *Southern M. Rep.*, 1849, *1*: 431.

[41] The works of Liebig were amazingly popular in the United States. By the middle of the 1840's, readers of even the most remote small town newspapers knew of his work. The interest of American medical men in the so-called ferment theory of disease seems, however, to mirror the interest shown it in England.

[42] William MacNeven: "Remarks on the mode by which cholera is propagated," *New York J. Med.*, 1849, s. 2, *2*: 194-195, 201; E. B. Haskins: "Some remarks on the febrile stage of cholera; with the suggestion of a new theory of the propagation and spread of cholera," *West. J. Med. & Surg.*, 1849, *3*: 384.

[43] A. B. Palmer: "Observations on the cause, nature, and treatment of epidemic cholera," *Peninsular J. Med. & Collateral Sc.*, 1854, *1*: 339; Thomas White: *The True Cause of the Cholera Explained . . .* (Cincinnati: James, 1850), p. 3.

and vomited fluids of infected persons." [44] These ideas, associated with the names of Snow and Pettenkofer, and current in medical circles for a dozen years, were widely accepted by American physicians. In the spring of 1866, the New York Academy of Medicine resolved *unanimously*: [45]

> . . . that in the judgment of the Academy the medical profession throughout this country should, for all practical purposes, act and advise in accordance with the hypothesis (or the fact) that the cholera diarrhoea and "rice-water discharges" of cholera patients, are capable, in connection with well-known localizing conditions, of propagating the cholera poison; and that rigidly enforced precautions should be taken in every case of cholera to permanently disinfect or destroy those ejected fluids . . .

A few physicians rushed forward with claims that they had been teaching this doctrine for over a dozen years—a conclusive symptom of intellectual fashionability. By 1866, there were few intelligent physicians who doubted that cholera was portable and transmissible: many considered the evacuations of cholera patients the most likely channel for this spread. Even the most cautious could agree that "if cholera is communicable, it is probably so through the stools." [46]

The rapid assimilation of these new ideas should not be surprising. Many American physicians were readers of European medical journals.

[44] New York State, Metropolitan Board of Health, *Annual Report . . . 1866* (New York, 1867), p. 204 appendix. This portion of the report was signed by Elisha Harris, a prominent New York sanitarian. Elsewhere (*Tr. A.M.A.*, 1867, *18*: 431-437) Harris states that he has believed in this doctrine of the infection of cholera since 1854.

[45] This resolution was printed in full in the *M. & S. Reporter*, 1866, *15*: 54. The clause referring to "well-known localizing conditions," was obviously necessary if a unanimous vote was to be recorded.

In a sampling of the opinions of one hundred and twenty-eight physicians—not including the above-mentioned vote—fifty-five were found to have taken a thoroughly contagionist stand: twenty-one were contingent contagionists. Fifty-two remained anti-contagionists. Forty-five accepted at least some of the conclusions of Snow and Pettenkofer, while twenty-two were believers in some variation of the germ-theory. The atmospheric theory found twenty-nine believers, while a sprinkling of others believed in variations of it (electricity, miasma, aerial ferment). Thirteen who favorably cited the work of Snow or Pettenkofer also felt that the atmosphere played a role in the communication of the disease.

It should be noted that Pettenkofer was in the context of his time a contagionist, for he emphasized the role of human beings in the spread of cholera and stated, moreover, that it was probably caused by some micro-organism.

[46] From a circular prepared by a committee of the Buffalo Medical Society, *Buffalo M. & S. J.*, 1866, *5*: 389. George Sutton ("A summary of observations on the cholera," *M. & S. Reporter*, 1866, *14*: 281-283) and Thomas Rochester ("A few remarks on cholera," *Buffalo M. & S. J.*, 1866, *5*: 461-464; *6*: 1-9) both asserted that they had been teaching this doctrine for many years.

A greater number kept abreast through the "eclectic" sections of the better American medical journals.[47] (These consisted of summaries of the more important articles in the major French, English, and, by the time of the Civil War, German medical journals.) The ideas of Snow, Budd, Pettenkofer, and Griesinger were no more distant than the nearest post-office. So rapid, indeed, was the assimilation of Snow's work in the eastern United States, that as early as the summer of 1855, his principles were being applied in the administration of the New York State quarantine hospital on Staten Island.[48] Immigrant physicians provided another source of knowledge. In Cincinnati, St. Louis, and New York, such men were leaders in advocating contagionism. By settling in these opinion-forming urban centers, a few emigrees might exert an influence far out of proportion to their numbers.

But opponents were still numerous in 1866. Cholera might be portable, but it certainly did not seem to be contagious. There were still physicians who could deny that cholera was contagious, "rather in the interest of humanity than on the side of mere theory." Older men, like John H. Griscom, Edwin Snow, and Henry G. Clark, who had spent decades in fighting for sanitation and against filth, could not easily accept a doctrine which promised to destroy the rationale of their work. Commercial interests also found these new ideas—and the rigid quarantines they implied—unpalatable. When William Read, Resident Physician of Boston, announced his conversion to the ideas of Snow, he was quickly reprimanded for espousing doctrines "detrimental to the health, happiness and pecuniary interests of the citizens at large."[49]

But now the anomalies which had confounded contagionists in past epidemics could be explained. Knowing that cholera might be spread through a water supply or carried by seemingly healthy persons, the followers of Snow and Pettenkofer were able to display in the progress

[47] John Shaw Billings noted in 1876 of the *Am. J. M. Sc.*, that so excellent were its, "abstracts and notices of foreign works, that from this file alone, were all other productions of the press for the last fifty years destroyed, it would be possible to reproduce the great majority of the real contributions of the world to medical science during that period." *A Century of American Medicine, 1776-1876* (Philadelphia: Lea, 1876), p. 333.

[48] New York State, Metropolitan Board of Health, *Annual Report . . . 1866*, p. 217 appendix.

[49] Read: *A Letter to the Consulting Physicians of Boston . . .* (Boston: Mudge, 1866), p. 5; John F. Geary: *Epidemic Cholera . . .* (San Francisco: Bancroft, 1866), p. 43; Edwin M. Snow: *A Report upon Sundry Documents Relating to Asiatic Cholera*, Providence City Document No. 5 (Providence: Knowles, Anthony, 1865), p. 9; for Griscom, *see Bull. New York Acad. Med.*, 1866, *3*: 6 ff., and for Clark, *see Boston M. & S. J.*, 1865, *73*: 225 and *M. Rec.*, 1866, *1*: 437-9.

of the epidemic irrefutable evidence for their convictions. Its transmission by human intercourse seemed too apparent to admit of doubt. In Chicago, the outbreak of the disease was traced to a Mormon immigrant. In Pittsburgh, a few seemingly spontaneous cases on the outskirts were all eventually traced to contacts inside the city. New York, however, was the scene of the most striking demonstration of the validity of the "Snow-Pettenkofer" theory. The Metropolitan Board of Health, created in the early spring of 1866 to fight the epidemic, succeeded, by using prophylactic methods based on these theories, in limiting the epidemic in New York City itself to a few hundred cases.[50]

The common people, of course, continued in their unchanging belief that cholera was contagious. Mobs were still one of the normal operating hazards of cholera hospitals. But now, the theories of Snow and Pettenkofer, rather than ozone and electricity as in 1849, were urged upon their readers by newspapers and magazines. Contagionism had become respectable. In Chicago, for example, a correspondent noted that the general opinion "was that the foecal matter from the cholera patient spreads the disease. Whether it becomes contagious to the attendant or filters from cess-pool into well, it is sure to carry cholera."[51]

Naturally, most physicians, as well as laymen, confused the concepts of Snow and Pettenkofer with each other, as well as with other ideas, older and more accustomed. Belief in predisposing causes continued, regardless of any other ideas a medical man might entertain. Many physicians able to espouse these newer ideas continued to assign a role to the atmosphere in the spread of the disease. One Yankee physician, who quoted Griesinger and cited Pettenkofer, Snow, and Budd, could also marshall an imposing catalogue of predisposing causes, among them "lewdness," and remark that after an epidemic had broken out, an "infection pervaded the air." Other physicians believed that the cholera evacuations had an "infective" or "zymotic" quality only in an atmosphere contaminated with exhalations from decomposing organic matter.

[50] T. Bevan: "The recent epidemic of cholera at the County Hospital, Chicago, 1866," *Chicago M. J.*, 1866, *23*: 450-459; Thomas J. Gallagher: "Report of the Allegheny County Medical Society," *Tr. M. Soc. Pennsylvania*, 1867, p. 202.

[51] Letter from "Mosely," dated Chicago, Sept., 1866, New York *Evangelist*, Sept. 13, 1866. Cf. "Epidemics, past and present," *Catholic World*, 1866, *2*: 427; William H. Draper: "The march of the cholera," *Galaxy*, 1866, *1*: 107-115; Chicago *Daily Republican*, Aug. 13, 1866; Cincinnati *Volksfreund*, Aug. 10, 1866; *Brownlow's Knoxville Whig*, Aug. 22, 1866; Cincinnati *Daily Gazette*, Aug. 21, 1866; New York *Times*, Jan. 21, March 12, April 9, 1866; Chicago, *North-Western Presbyterian*, Oct. 20, 1866; Baltimore *Catholic Mirror*, May 5, 1866; Yorkville, S. C., *Enquirer*, Feb. 8, 1866.

(Or perhaps, as many felt, a contaminated atmosphere—as in a slum—must weaken the "system" and predispose it to cholera.)[52]

Many doctors who accepted the notion that human excreta had something to do with the spread of the disease, failed to understand that these evacuations could spread cholera only if they contained a specific organism or poison. "It has been supposed," wrote one California physician, "that fecal discharges, under some circumstances, favor the production of cholera—especially those from patients suffering with the disease." A New Orleans doctor agreed with the general opinion that the cholera poison was spread through the excrements, "but not to the extent that many represent. It has to be concentrated and confined."[53] The idea that some interval or "fermentation" period was necessary before the feces could become infectious was quite common, though Pettenkofer's elaborate theory justifying this was unknown or misunderstood.

It is unnecessary to outline the many ways in which older ideas survived: unnecessary, because they differed in most cases only in detail from those held in 1832 and 1849. Almost half of the physicians sampled in 1866, for example, continued to believe that the atmosphere was a primary medium for the spread of the disease. The vagaries of the epidemic were still explained in terms of "local exciting causes." But new habits of thought, perhaps less conspicuous, betokened the future.

Arguments based on formalistic philosophical assumptions almost ceased. Statistics and careful observation replaced tortured and abstract reasoning. (The imperfections which marred this work do not invalidate the importance of a newly felt need to perform it.) Perhaps most striking was an almost unquestioned assumption of the specificity of the disease. One heard almost nothing of "universal bowel complaints," of diarrhea "shading into cholera," of cholera transforming itself into typhus.

[52] Linus P. Brockett: *Asiatic Cholera* . . . (Hartford: Stebbins, 1866), pp. 62, 96, 99-103, 144-146, 175, 185. The International Sanitary Commission, for example, which met at Constantinople in 1866 and reported unanimously in favor of the transmissibility of the disease, endorsing unanimously the idea that the cause of the disease was reproduced in the body of the sufferer, also voted that "the principle of cholera . . . is volatile, and acts in this respect after the manner of miasma; that is to say, by infecting the atmosphere." International Sanitary Conference, *Report . . . of a Committee from that Body, on the Origin, Endemicity, Transmissibility and Propagation of Asiatic Cholera*, tr. by Samuel Abbott (Boston: Mudge, 1867), pp. 24, 38, 40, 94-95.

[53] H. Gibbons: "Hygiene of cholera," *Pacific M. & S. J.*, 1865, *8*: 243; Warren Stone: "Cholera and its treatment," *New Orleans M. & S. J.*, 1866, *19*: 17; J. H. P. Frost: "Report of the Committee on Cholera," *Tr. Homoeo. M. Soc. Penn.*, 1866-7, pp. 94-105.

One might admit the specificity and portability of cholera and still find fault with the theories of Snow and Pettenkofer. Pettenkofer especially was the object of much criticism. To some, his *Grundwasser* theory was nothing more than an "irreconciliable absurdity." Cholera had spread in the frozen snows of Russia and in the deserts of Arabia. It had made its appearance in places where there could not have been the slightest trace of sub-soil filtration. It had prevailed in a citadel perched on the top of one thousand feet of solid rock, while the city at foot of the mountain escaped. Many other critics emphasized the inability of Snow or Pettenkofer to explain the "isolated cases" which had occurred.[54]

The assumption that cholera might be caused by micro-organisms met with a mixed, though promising, reception in the United States. Twenty years of scientific advance had made this idea seem less bizarre than it had in 1849. The popular furor, for example, over the "trichina disease" was at its height in the spring of 1866.[55] Even those who opposed the idea that "mere worms" could cause such a serious illness, frequently were led to argue that such parasites were normal inhabitants of the body and hence harmless. Moreover, the work of Pasteur and other scientists on fermentation and spontaneous generation was, at the same time, becoming known to the general public.[56]

Let us not distort our understanding through hindsight. Physicians believing in some sort of "germ-theory" were still in a small minority—roughly one in seven—while their ideas were often crude and inconsistent. But they were listened to and could no longer be dismissed with a few words of casual ridicule. The painstaking studies of Snow and Pettenkofer had provided the epidemiological underpinning for the rapid and natural acceptance in the United States of Koch's discovery of the cholera *vibrio* (1883). As early as 1869, even a firm believer in miasmas had to concede that he was "very fond of the cell theory," and predict that

[54] Thomas Kennard: "Cholera—its history, causes, pathology, and treatment," *St. Louis M. & S. J.*, 1867, n. s. *4*: 123; N. S. Davis, Chicago *M. Examiner*, 1867, *8*: 656; A. P. Morrill, *Galveston M. J.*, 1866, *1*: 143; William Elmer, *Tr. M. Soc. N. J.*, 1867, p. 252, and J. S. B. Alleyne, *St. Louis M. Reporter*, 1866, *1*: 192 all argue that the erratic spread of the disease is not adequately explained by these new ideas.

[55] For representative articles on the "trichina disease," *see* the Green Bay, Wis. *Advocate*, April 26, 1866; Chicago *Republican*, April 14, 1866; Boston *Christian Register*, March 31, 1866; New York *Journal of Commerce*, March 26, 1866; New York *Sunday Dispatch*, Feb. 11, 1866.

[56] "W" in the Boston *Zion's Herald*. An unsigned article in the New York *Times*, March 12, 1866, significantly enough, calls the organisms which cause cholera—and upon which Pasteur has been working—insects.

there was "more truth to be developed from that idea than from any other view before the professional mind." [57]

The most compelling of arguments for the organic causation of the disease rested on the assumption that only living things had the power of indefinite reproduction, while epidemiological evidence indicated that the cause of cholera was some specific and indefinitely reproducible poison. Though no chemical or microscopic analysis had as yet discovered such subtle organisms, "yet their existence cannot be denied, or we must admit that these diseases can exist without a cause." The very rapid transmission of the poison and the lethal effect which could be produced by the ingestion of a very small quantity also implied that it had the power of reproduction and was hence organic.[58]

The ferment theory, even more pervasive than it had been in 1849, did not clash with the ideas of Snow and Pettenkofer, or with the conviction that cholera might be caused by living organisms. (The morbid fermentations within the body—which constituted the disease—might well be caused by a micro-organism, as were the fermentations which produced beer and wine.) Almost all those who held that cholera evacuations were not immediately infectious, believed that it was some "fermentation" process which transformed the once harmless excreta. The ideas of Snow could be easily assimilated as well.

> The researches of the late Dr. Snow render it highly probable that the disease often arises from drinking water, impregnated with the *fermenting* excreta of persons suffering from the disease.[59]

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[57] Remarks of Dr. John O. Stone, at a meeting of the New York Academy of Medicine, February 11, 1869. *Bull. New York Acad. Med.*, 1869, *3*: 396 ff.

[58] W. S. Haymond: "The collapsed stage of cholera," *Tr. Indiana State M. Soc.*, 1867, p. 101; William Schmoele: *An Essay on the Cause . . . of the Asiatic Cholera and other Epidemics* (Philadelphia: King and Baird, 1866), pp. 17-20; J. M. Toner and Charles A. Lee: "Facts and conclusions bearing upon the questions of the infectious character of asiatic cholera," *M. Rec.*, 1866, *1*: 201-205; Kennard: "Cholera . . ." *St. Louis M. & S. J.*, 1866, n. s. *3*: 133; Henry Hartshorne: *Cholera: Facts and Conclusions as to its Nature, Prevention, and Treatment* (Philadelphia: Lippincott, 1866), pp. 46-47.

[59] "Epidemics, past and present," *Catholic World*, 1866, *2*: 427; significantly enough, the passage continues: ". . . and if this be so, from what we know of other diseases, it is not unreasonable to infer that, in certain conditions of the atmosphere, the poison of the cholera may be generated during the fermentation of the excreta of healthy persons." M. Herzog: "Our present knowledge of the causes of cholera," *M. Rec.*, 1867, *2*: 193; L. Ch. Boisliniere, *St. Louis M. & S. J.*, 1866, n. s. *3*: 489, suggests that "either Liebig's albumoid, or Pasteur's animalcular," theory may be adopted to account for the fermentation. Cf. Phillip Harvey: "Asiatic cholera," *Iowa M. J.*, 1868, *5*: 55-56; John Ordronaux: *Prophylaxis*, an Anniversary Oration Delivered Before the New York Academy of Medicine . . . (New York: Ballière, 1867), pp. 48-57.

When, in 1873, cholera again attacked the United States, few physicians clung to traditional anti-contagionist theories. Their inadequacy had become more apparent with each succeeding cholera epidemic. Dozens of communities, large and small, now utilized the prophylactic methods which had protected New York in 1866. The success of these procedures provided conclusive evidence for the theories upon which they were based.

American medical thought had passed seemingly through centuries rather than decades in the years since cholera had first appeared on this continent. New ideas, new assumptions, and new habits of thought had supplanted those dominant forty years before. American physicians readily accepted the discovery of the cholera *vibrio* in 1883. Many had expected it, for they had been brought, step-by-step, to an intellectual position which could easily assimilate it.

HIPPOCRATIC DESCRIPTION OF METABOLIC DISEASES IN RELATION TO MODERN CONCEPTS

RUDOLPH E. SIEGEL

In some passages of the first book *On Regimen*, the Hippocratic author describes concepts of metabolic diseases, evidently for the first time in the history of medical thought. It is difficult to recognize diseases in our sense from the ancient medical texts since many terms have both philosophical and scientific meaning. For better understanding of these ideas, we have to combine two different approaches: we have to discuss the relationship of the medical ideas to the philosophical background of the times, and we have to trace the medical concepts through successive stages of development. This will give us an opportunity to follow the evolution of these scientific ideas and to observe the growth of the medical aspect of such early concepts.

The diseases of the thyroid, which I believe to recognize in the ancient text under discussion, have clinically important psychological features. In the Hippocratic description, this psychological aspect is prevalent. For this reason, it appears necessary to start this discussion with a short review of the Greek ideas of the problem of the psyche.

The pre-Socratic philosophers did not consider the world to be divided into the realms of soul and matter. The substrate of thought, the soul, was considered as something material. The puzzle of a division between the corporeal world and the forces of intellect did not exist for these thinkers, since the soul could act on the body in a mechanical sense. For the early Greek *physiologoi*, the phenomena of life and soul appeared inseparable from the problems of respiration. Air was considered to be the carrier of the vital principle. The same concept was predominant in contemporary Far Eastern thought. The Buddhist regarded the intellect as part of the body and equally subject to the laws of the physical world.[1] This is reflected in the language itself. The Greeks used the words for soul, air, and respiration interchangeably. The word *pneuma* represents these three meanings. Its etymological root is the verb *pneo*, I blow.

The thoughts of the Hippocratic school were greatly influenced by the philosopher Diogenes of Appolonia who lived in the latter half of the 5th

[1] P. Huard and Wong: "Le bouddhisme et la médecine chinoise." *Histoire de la médecine*, 1958, *8*: 26.

century B. C. on the shores of the Black Sea, about one generation earlier than Hippocrates, who was born about 460 B. C.[3] Diogenes thought that everything was derived from air by rarefaction and condensation.[4] He identified air and reasoning power. He even called the air divine since air represents the universal life-giving principle.[4] "It seems to me that what people call air contains the reasoning power"; "the soul of all living creatures is the same." He believed that respiration fulfilled a two-fold function: Supplying the material sustenance of life in the sense of nutrition, and connecting the body with the vital spirit. Whereas modern physiologists recognize only a causal relationship between the act of breathing and the maintenance of life, these philosophers considered both functions simply as two qualities of the inhaled pneuma. The eternal riddle how the physico-chemical transaction of metabolism and the intellectual forces are connected was answered by the Greek philosophers simply through identification of the nutrient air with the spiritual principle. The post-mortem presence of air in the arteries was considered to be proof of this concept. The anatomy of the bloodvessels interested Diogenes considerably, and he discussed it at great length.[5] He also recognized that fish maintain their life by withdrawing air from the surrounding water through their gills.[6] These observations seemed to prove the general validity of his theory of respiration.

The pseudo-Aristotelian book *On Breath* was probably written at the same time as the Hippocratic book *On Regimen.*[7] Its author reveals a profound understanding of the problems involved in respiration and metabolism. This is remarkable because of the complete absence of chemical concepts at that period. His views differ from those of Aristotle who erroneously maintained that the only purpose of respiration is its cooling effect on the body.[8] The writer of the book *On Breath* recognized that "Nutrition may occur in two ways, either by respiration, or, . . . by digestion of food . . . What then is its method? Clearly by some extraction

[3] W. A. Heidel: *Hippocratic Medicine.* New York: Columbia Univ. Press, 1941, p. 51.
[4] H. Diels—W. Kranz: *Die Fragmente der Vorsokratiker.* 6th ed., Berlin, 1951, 64 A5.
[4] *Ibid.*, 64 B5.
[5] *Ibid.*, 64 B6.
[6] *Ibid.*, 64 A31.
[7] Hippocrates: with an English translation by W. H. S. Jones, 4 vols. (Loeb Classical Library). Vol. 4, p. XLVI.
[8] Aristotle: *On Respiration* 473 A3. (Aristotle: *On the Soul, Parva naturalia, On Breath*, with an English translation by W. S. Hett. Loeb Classical Library, 1957.) Aristotle writes: "Nor can we suppose that respiration is for the sake of nourishment by breath, on the assumption that the internal fire is nourished by breath, respiration acting as fuel to the fire."

and assimilation from the veins; for blood is the ultimate food for every part alike." [9] The rapidity of assimilation of the air (its "digestion") appeared to him unexplained, since expiration occurs directly after inhalation.[10] Neither did it escape him that exhaled air should contain some waste products of the body:

> . . . if all food has a residue, how is it expelled in the case of breath? [11] . . . For the lung does not dispatch the air the moment it is digested to the parts below . . . in this case the consequence is still more . . . incredible: viz., that digestion takes place merely by passage and contact.[12]

Thus he anticipated in some intuitive way the rapid exchange of gases contained in air and their circulation through the bloodstream. "If the breath is all-pervasive its purpose cannot be refrigeration. . . . The manner of its reflux, if it comes from all parts of the body, is astonishing, unless it returns from the extremities in some other way . . ." [13] He recognized the causal role of air for the maintenance of life but did not identify it with an undetermined vital principle, nor did he call air "psyche," "pneuma," or "soul." He wrote that air is not the whole of the soul, but something which contributes to such an activity (*dynamis*) and makes it appear to us as its essential principle.[14]

Democritus (about 420 B. C.) came closest to the concept of an interaction of the constituents of the air with those of the body. In his discussion of the atomic theory of Leucippus and Democritus, Aristotle wrote:

> It is the spherical atoms which they call the soul, because such shapes can pass most readily through anything, and can move other things by virtue of their own motion . . . the soul is that which imparts motion to living things. Hence they consider . . . that respiration is the essential condition of life . . . The theory handed down from the Pythagoreans seems to entail the same view; for some of them have declared that the soul is identical with the particles of the air, and others that it is the agent which makes these particles move.[15]

The writings of the pseudo-Aristotelian author, of Democritus, and of Diogenes, give us sufficient background material for the Hippocratic first book *On Regimen*, regardless whether the latter was written by Hippocrates or by one of his pupils. The writer of this treatise did not speak of the composition of the body by three or four humors which we find discussed in most other parts of the Hippocratic writings. He dis-

[9] Aristotle: *On Breath*, p. 487 (adapted).
[10] *Ibid.*, 481 B10.
[11] *Ibid.*, p. 489.
[12] *Ibid.*, p. 491.
[13] *Ibid.*, p. 495 (adapted).
[14] *Ibid.*, 483 A33-36.
[15] Aristotle: *On the Soul*, p. 21 (adapted).

cusses only the equilibrium of fire and water in the human body. These two elements should probably not be understood in a literal sense.

A harmonious balance of the constituents of the body as a guarantee for health had first been advocated by Alcmeon. This philosopher-physician lived in the beginning of the 5th century B. C. He did not limit these factors to a definite number. He considered a disturbance of their equilibrium to be a cause of disease. In accordance with Alcmeon's ideas, the author of the book *On Regimen* wrote:

> If indeed . . . it were possible to discover for the constitution of each individual a due proportion of food to exercise, with no inaccuracy either of excess or of defect, an exact discovery of health for men would have been made . . . In fact, if there should occur even a small deficiency of one or the other, in course of time the body must be overpowered by the excess and fall sick . . . For diseases do not arise among men all at once; they gather themselves together gradually before appearing suddenly.[16]

As to the number of constituents, the author of the book *On Regimen* appears to be more specific than Alcmeon. The basic idea of his discourse is that only two elements, fire and water, hold each other in abeyance. We may regard this as the matching of a passive and an active agent. This aspect distinguishes his book from other chapters of the Hippocratic works, since in most parts of this collection opposite qualities are hardly discussed. In the equilibrium of fire and water, we recognize the contrasting qualities of hot and cold. But this writer had in mind more than that. He was thinking of the dynamic interaction of the two universal agents. In modern terms, we may recognize in this the balance between anabolic and catabolic processes, fire representing the active, catabolic agent, whereas water stands for the substratum of its activity. Fire would represent the forces of heat. These, at the same time, appear as the life-giving principle and are transmitted to the organs by respiration, the words for air and pneuma being used for this purpose alternatingly. The amount of fire present would indicate the degree of mental and vital activity of the person.

The Hippocratic author exhibits clearly that he considers all animals, including man, to be composed of these two factors of opposing activity, fire and water, which work in unison for the same purpose. He states that both are sufficient for this goal when acting together, but that each of them alone appears insufficient for any purpose . . . " The fire, when advancing to the limit of water, will lack nourishment, whereas water will

[16] Hippocrates: *On Regimen*, chapter II. *Loc. cit.*, vol. 4, pp. 229-231 (adapted).

find its motion fail when it advances beyond the confines of fire, and stop at that point. Neither of the two can become completely master." [17] In the following allegory he represents beautifully the idea of the balance of two chemical components. He writes that into the composition of the human body there enter numerous parts containing a mixture of fire and water, of which some are receiving, others are giving away. Those which take cause increase; those which give will cause decrease. And he compares these forces to men sawing a log: "The one pulls, the other pushes, but herein they do the same thing; and thus, when one does more work, the other does less. Such is the nature of man." [18] According to the author, individual souls also are composed of these two factors which balance themselves out according to their increase or decrease. The treatise, in its further course, stresses the psychological aspect more than the physiological problems. We omit the following chapters which are devoted to some astrological and mystic discussion. Subsequently, the writer returns to the description of the role of respiration.

It took untold time and effort for the modern concepts of respiration to take form. But "if these preliminaries seem long, and tedious, in respect of the origins of biochemistry, they are very important (Allbutt)." [19] "We must not expect of [the ancient author] . . . too much conformity with experience, too much scientific method. We must realize that they are in part works of imagination, often figurative, allusive and metaphorical." [20]—We know today that the intensity of mental and bodily activities varies according to the rate of oxygen consumption. The ancient writer expressed the relationship of respiration to mental activity by connecting the concept of soul to the act of breathing. We may call these the metabolic and psychological functions of the pneuma which appeared to him inseparable. The author of the book *On Regimen* wrote that the soul, being a blend of fire and water, enters into every animal that breathes and in particular into every man, young or old. It does not grow equally in all. In young bodies, where the changeover [21] is faster because of the growth of the body, it is used up for that growth, after being burned up and thinned; whereas in older bodies, the circulation being slow and the body cool, the soul is consumed into the weakening body.[22] "The various

[17] *Ibid.*, chapter III, p. 233 (adapted).
[18] *Ibid.*, chapter VI, p. 238.
[19] C. T. C. Allbutt: *Greek Medicine in Rome*. London: Macmillan, 1921, p. 233.
[20] Hippocrates, *op. cit.*, p. xxiv.
[21] *Periphore* in Greek, i. e. that which moves in a circle.
[22] Hippocrates, *op. cit.*, chapter XXV, p. 262.

ages stand thus in relation to each other." [23] "Growing creatures have most innate heat, and it is for this reason that they need most food, deprived of which their body pines away. Old men have little innate heat, and for this reason their body needs very little fuel. Much fuel puts it out. For this reason, too, the fevers of old men are less acute than others, for the body is cold." [24] It seems that the author of the treatise *On Regimen* associated with his concepts of respiration an intuitive anticipation of the idea of combustion. He wrote: "If any one doubts that the soul combines with the body [25] let him consider coals. Let him place lighted coals on unlighted [26] . . . All present a similar substance and one will not be distinguished from another, but the whole will be like the body in which they are kindled. And when they have consumed the available nourishment, they dissolve into invisibility. So, too, it is with the soul of man." [27] This idea of combustion by pneuma we encounter again in the book *On Airs* (*peri physōn*): "Pneuma is nourishment for the fire; deprived of pneuma, the fire cannot burn." [28]

After these observations, the author of the book *On Regimen* continues with a discussion of constitutional and psychological consequences of different types of blending of fire and water. In the course of these chapters, we are frequently reminded of certain clinical features of diseases of the thyroid gland. What we call an increase of the oxygen consumption, corresponding to an increased use of air, appeared to the ancient writer as a prevalence of pneuma or fire. The interest of the writer in these diseases arose from the unique combination of physical and psychological features which accompany these metabolic variations. He began with the words: "The facts are as follows with regard to what are called the intelligence and sensitiveness of the soul and the want of it." [29] He considered that an addition of either water or fire to the body would result in a disturbance of the intelligence because things blended in the original

[23] *Ibid.*, chapter XXXIII, p. 279.

[24] Hippocrates: Aphorisms I, XIV. *Loc. cit.*, vol. 4, p. 105 (adapted).

[25] I accept here the reading of the manuscript which has *physei* instead of *psychei*: *see* Hippocrates: *On Regimen, loc. cit.*, vol. 4, p. 270, ftn. 2.

[26] According to the reading by Littré, which Jones rejects (p. 271, ftn. 1).

[27] *Ibid.*, chapter XXIX, pp. 270-271 (adapted).

[28] Hippocrates: *Sämmtliche Werke.* Ins Deutsche übersetzt und ausführlich commentiert von R. Fuchs. München: Lüneburg, 1895, vol. I, p. 443: *Die Winde* (The Winds: *peri physōn*), chapter III.

[29] Hippocrates: *On Regimen*, chapter XXXV, p. 281 (adapted).

way are most perfect and self-sufficient. If fire fell a little short of water, such persons, too, would be intelligent, but inferior to the former blend, because the fire, slowed down by the greater power of the water, would exhibit a more sluggish reaction. He believed that this type of man under the right regimen might become more intelligent and sharper than natural endowment permitted. He recommended a regimen of sharp runs, walks, vomiting, unctions, and certain other practices. He continued that if the fire exhibits an activity much inferior to the water, such a person will be of necessity slower; people of this type are called stupid. Their sense impressions become of short duration and the degree of their assimilation and power of combination is low because of the slowness of the circulation. He states that persons of this kind perceive as well as others the sensations of hot or cold, but that they cannot well perceive sensations of sight and hearing unless they are already familiar with them. Souls of this kind have this defect because of their clumsiness. If their regimen were rightly regulated, even these people might improve to some extent. He wrote:

> . . . if the fire should be mastered to a greater extent by the water in the soul, we have then cases of what are called by some "senseless" people, and by others "grossly stupid." Now the imbecility of such people inclines to slowness; they weep for no reason, fear what is not dreadful, are pained at what does not affect them, and their sensations are really not at all those that reasonable persons should feel.[30]

We can recognize in this description the behaviour and attitude of patients in all stages between simple hypothyroidism and myxedema, although the text does not mention the characteristic facial and bodily features of such persons. The famous psychiatrist, Kraepelin, described endemic cases of hypothyroidism in upper Bavaria with somewhat similar words, most likely without knowledge of the passage in the book *On Regimen*.

> The mental attitude exhibits a goodhearted clumsiness, which can present all variations from great stupidity to simple mental retardation which imperceptibly borders on the normal. Changed conditions of living, especially the supply of good drinking water, have resulted in a gradual decrease of endemic cretinism.[31]

The opposite condition would be hyperactivity of the thyroid, which, in the terms of the ancients, would be considered a prevalence of fire. We should expect that a description of this condition by the ancient writer

[30] *Ibid.*, p. 287 (adapted).

[31] E. Kraepelin: *Einführung in die psychiatrische Klinik*. Leipzig: J. A. Barth, 1916, p. 329.

would remind us of Grave's disease. Again we should not expect a complete clinical description, since the typical physical findings were not associated with the psychological observations. The Hippocratic author wrote that if the power of water is mastered by the fire, the soul must be quicker in proportion to its more rapid motion and react to sensations more rapidly: but that it had less constancy than the souls discussed above, because it more rapidly passes judgment on the things presented. On account of its speed, it rushes on to too many objects. He advised that such a person may be benefited by a regimen inclining more to water.[82] He recommended a diet of fish rather than meat, restraint from drinking and sexual activities, moderate exercise, avoidance of stress. He further described more severe cases:

> A soul of this sort . . . turns to madness . . . Such persons are . . . benefited if they eat a meal before they go about their duties, instead of doing them without food, as their soul is more stable when it is mixed with its appropriate nourishment than when it lacks nourishment . . . But . . . such a soul is too quick, and men of this type inevitably suffer from dreams. They are called "at the verge of madness," their condition in fact is next door to madness, as even a slight untoward inflammation results in madness, whether arising from intoxication, or from over-abundance of flesh, or from eating too much meat.[83]

In any modern textbook, we will find that hyperthyroidism, which can occur with or without an enlargement of the gland, may exhibit an increased skin temperature, marked nervous manifestations, a change in disposition with unwonted irritability and unexpected loss of temper. Even true psychoses may occasionally intervene.[84] Vegetarian diet is recommended.

In regard to the apparent similarity of the ancient account to the clinical pictures of metabolic diseases, it should again be stressed that the ancient author described only his psychological observations, using the philosophical terms of the period. It appears likely that he based his remarks also on clinical experience. In his writing, he was preoccupied with the humoral theory and the concept of the balance of basic elements. But he intuitively recognized the difference of these cases from purely constitutional variations of human behavior. He did not consider that all mental symptoms and attitudes were caused only by an imbalance of fire and

[82] Hippocrates: *On Regimen*, chapter XXXV, p. 289.
[83] *Ibid.*, p. 291 (adapted). Kuehn calls this state 'subfurious.'
[84] R. Cecil (ed.): *A Textbook of Medicine by American Authors.* 5th ed., Philadelphia, London: W. B. Saunders, 1940, p. 1297.

water, by the lack or excess of either one. He recognized inborn constitutional factors as worthy of careful consideration by the psychologist. Referring to the imbalance of water and fire and the disturbance arising from it, he said:

> It is this blending then, that is, as I have now explained, the cause of the soul's intelligence or want of it; regimen can make this blending either better or worse . . . But in the following cases the blend is not the cause of the characteristic:—irrascibility, indolence, craftiness, simplicity, quarrelsomeness and benevolence. In all these cases the cause is [inherent in] the nature of the passages through which the soul passes. For such dispositions of the soul depend upon the nature of the vessels through which it passes, upon that of the objects it encounters and upon that of the things with which it mixes. It is accordingly impossible to change the above dispositions through regimen, for invisible nature cannot be moulded differently.[35]

This quotation demonstrates that the ancient author was aware of the difference between basic psychological characteristics and temporary, reversible changes of behaviour of persons afflicted with a metabolic disease.

Although the concepts of metabolism had been intuitively grasped by the authors of the first book *On Regimen* and *On Breath*, the scientific application of the ideas involved had to wait for the chemical discoveries of the 18th and 19th century. The role of the "fire" and the problem of "animal heat" led, in the final outcome, to the discovery of internal combustion by Lavoisier. Claude Bernard wrote in 1876: "We know that man and animals produce heat. This fact has been justly appreciated from oldest times. If we can reproach the ancients for one thing, it is that they exaggerated rather than played down its importance. The reason was in their language and that in the beginning they identified heat with the vital principle and cold with the cause of death." [36] "Lavoisier, in 1777, demonstrated in his famous experiments that a close relationship exists between the phenomena of respiration and those of actual combustion. Respiration is for him a slow or fast combustion . . ." [37] "Like all scientific questions, the one concerned with 'animal heat' has passed through two phases: the phase of hypothesis and the phase of experimentation." [38] Hippocrates stood at the threshold of the first phase of research, the phase of hypothesis. But we should not shrug our shoulders at the results of his early attempts. Claude Bernard rightfully stated:

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[35] Hippocrates: *On Regimen*, chapter XXXVI, p. 293 (adapted).
[36] Claude Bernard: *Leçons sur la chaleur animale*. Paris: Baillière, 1876, p. 17.
[37] *Ibid.*, p. 22.
[38] *Ibid.*, p. 17.

> Not that I want to say that hypotheses should be rejected by science . . . Illegitimate is only the sterile hypothesis which does not search for verification in experience, which believes itself self-sufficient, but not one which provokes research and experimentation and which is, according to an expression of Bacon, "an idea which anticipates." [39]

The ideas of the Hippocratic physicians concerning the role of respiration, air, and fire were such anticipating insights into the physiology of the human body. Hippocrates himself claimed priority for some of his ideas: "I shall explain . . . the nature of those things which none of my predecessors has even attempted to set forth." [40]

[39] *Ibid.*, p. 20.
[40] Hippocrates: *On Regimen*, chapter I, p. 227.

TEXTS AND DOCUMENTS

A SEVENTEENTH-CENTURY LONDON PLAGUE DOCUMENT IN THE WELLCOME HISTORICAL MEDICAL LIBRARY:

Dr. Louis Du Moulin's Proposals to Parliament for a corps of salaried plague-doctors.

F. N. L. POYNTER

With a biographical note on Louis Du Moulin by W. R. LeFanu.

Those who have read Charles F. Mullett's recent work on *The Bubonic Plague and England* (1956), or the earlier classic by F. P. Wilson on *The Plague in Shakespeare's London* (1927), will have some idea of the sheer misery which the plague brought to the inhabitants of London for long periods of the seventeenth century until it culminated in the great epidemic of 1665. Among the measures for dealing with the constant outbreaks were official orders and regulations issued by the Privy Council on behalf of the crown and by the Lord Mayor for the City of London, but there was little or no organization for the medical care of the hundreds and thousands of patients. Year after year, in the first half of the century, the plague returned to London, and each time it had to be treated as a fresh emergency.

Among the population of London there were immigrant groups who had personal knowledge of how much better was the public health organization in some foreign cities, and among these groups were the members of the French and Dutch protestant churches in London. Mindful of their Christian duty towards the sick and the dying, they regularly sent "consolators" to houses infected and so disobeyed the rules for isolation, rejecting the suggestion implicit in the regulations that Christian men and women should be left to die alone and untended like animals. It is appropriate then that one of their number, Dr. Louis Du Moulin, should have prepared a petition to be presented to the House of Commons pleading that a regular salaried medical service should be established for those sick of the plague. The proposal was not entirely novel in 1641, for 11 years earlier, in 1630, the Privy Council had accepted a proposal made by the College of Physicians that a few of its members should be

nominated as plague doctors at a salary of £400 a year, with £200 a year for life and £100 a year for the widow of any who should die of the plague. Like so many reforms at that time, it was accepted and pigeonholed, but nothing was done. Du Moulin's petition was equally fruitless, but it contains, apart from the light it throws on the character of its originator, interesting comment on the age-old problem of providing medical care in spite of the dangers of infection. It also provides interesting information on the standards of medical care in seventeenth-century London. Few physicians stayed in London during an epidemic of plague, but it was apparently thought reasonable that two, or at the most four, physicians could deal with plague in an urban population of 400,000, assisted by an equal number of surgeons and apothecaries. The financial aspects of the scheme indicate that there were about 50,000 houses in London in 1641. The number of " 122 parishes and the city of Westminster " is mentioned, but the number is given by other seventeenth-century sources as 97 within the walls and 16 without, making 113. Two of the three parishes which made up the city of Westminster are included in the 16, so it must be supposed that Du Moulin's total is made up of the remaining parish of Westminster in addition to the 8 outer or suburban parishes.

An Humble Remonstrance to the Hon^ble^ House of Commons

Humbly sheweth, that Six yeeres agone there issued foorth an Order from his Ma^tie^ and an advise from the Colledge of the Phisicions of London that, answerably to the Example of well ordered (populous) Citties as Paris, Rome, Lion, Burdeaux, Venice, Padua, and Amsterdam, there should be appointed by the Citty of London, both in time of infection and out of infection, a competent number of Phisicions, Surgeons and Apothecaries, to bee att all times ready to bee only imploied when need requires about visiting and curing those that are infected with the plague; And that stipends should be graunted unto them & to their surviving widdowes.

Sheweth also, that since and for want of putting this order in practice the plague is become amongst us not only of the nature of other diseases which are within the compasse of the weekely casualties. But also is like to chaunge most of the other Maladies into it selfe and, which is worse, to bring by reason of its spreading infection the usuall number of the Dead, which is but little out of the infection, to a huge and fearefull increase; And the more because most, if not all, the people infected depart-

ing this life doe die in a most unchristian manner, without any succour, reliefe, and comfort by any phisicall helpe, Whereas for the most parte they might have recovered if rationall and speedy meanes had bene applied to them.

Sheweth likewise to the Hon^ble^ House of the great and urgent need to putt from henceforth such an Order in Execution more then heretofore by reason of the long and frequent sittings of Parliament, which by God's grace are vouchsafed to this happy land of ours; And therefore great diligence should bee had for the preservacion of the whole and of each member of the most Hon^ble^ Court that by God's mercy noe infection may approach unto any of them and that the said High and Hon^ble^ Court bee not constrayned, for to shun the spreading Infection, to keepe elsewhere their sitting than in the most convenient usuall place of Westminster to the great damage of all his Ma^ties^ Subjects, the disturbance of Parliamentary proceedings, and the great decay of trading of the most famous and Metropolitan Citty of London.

The Remonstrants therefore, not for any respect but publike, the Glory of God, the preserving of his Ma^ties^ Subjects from that mortality that overunnes so fiercely our dwellings, And particularly the safety of the High and hon^ble^ Court of Parliament and of each member thereof, doe Humbly present this Remonstrance to the end it may please the hon^ble^ house to take the contents thereof into due and serious consideration as being, next after the preaching of the gospell and the settling of Reformation, most materiall and necessary to bee debated, weighed and ordered. And further the Remonstrants, to testifie their readines for the publike good, doe willingly offer their owne persons in sacrifice to the safety of the Common wealth & wellfare of the most High & hon^ble^ Court.

May it please therefore the hon^ble^ house to order or cause to bee ordered That a sufficient number of Doctors in phisicke approoved of by the Colledge of Phisicions, and likewise of Surgeons and Apothecaries comended & allowed by the M^r^ and Wardens of their Hall bee sett apart only for the employment aforesaid; And that meanes bee raised by annuall contributions out of the Citty of London and the partes thereunto adjacent for their maintenance; And that they be sworne to visitt anyone whomesoever they are called unto. The Remonstrants doe further represent of the conveniency and necessity of speedy effecting the contents of this Remonstrance rather during the slackning of the infection, Least afterwards when the evill groweth afreshe, deliberation being taken, it bee then unreasonable and it bee too late to consult about a thing which should have been before ordered.

The several names of the Remonstrants are given upp to Doctor Meverell President of the Colledge, and to M^r^ Bell Burgesse for the Citty of Westminster & Master of the Apothecaries company; As also to the Master and Wardens of the Surgeons Hall. And further, the Masters of the said 3 professions, viz. the President and Censours of the Colledge of Phisicions and the Masters and Wardens of the Surgeons and Apothecaries, and with them Mr Lipton, Surgeon of the Pest House, doe jointly concurre with the Remonstrants in desiring and craving the Honourable house for the speedy regulating soe necessary and beneficiall a worke; And further, they make noe question that the Lord Maior and the Aldermen of the Citty of London and the Justices of Peace of Middlesex shall with unanimous consent like and desire the effecting of it.

A short draught humbly presented to the (consideration of the) Honourable house of Commons showing how to bring to passe the substance of the Remonstrance.

1. To provide Three or Foure, att least Two, of each profession for the service of the 122 parishes and the Citty of Westminster which bee tied under a penalty within the time of infection to admitt none or to resort to none but those that are within infection & keepe themselves and their families from having communication with others.
2. That they bee tied to visitt the poore for God's sake and the abler sort of people for the ordinary fees expecting noe more, or rather less recompense then would be expected out of infection.
3. Each Physitian to have £300 per Annum, Surgeons £150, Apothecaries £100 and the medicaments administred to the poore allowed.
4. Any of them dying, the widdow to have the 3rd parte of her husband's stipend during her widdowhood.
5. A contribution for their maintenance to bee levyed out of the 122 parishes and the Citty of Westminster, Those within London walles being rated att £15 one with thother, and the out parishes att £40. The yeerely totall will amount to £2500 and bee soe little burdensome that it wilbe scarcely 3^d^ a quarter for every house, yet it will discharge every parishe of greater expences they are att every yeere towards the infected of the plague.
6. Every house to bee rated by the officers of each parishe and the Collectors for the poore to receive the contribution quarterly and have 4d a pound for their paines.

7. A company or society to bee instituted of those Phisicions Surgeons and Apothecaries appointed for that service and joine their endeavours and studies for the publike welfare and give an accompt of their receipts and expences to the Justices of Peace of London and Middlesex.
8. A generall Collector for the new company or society to bee appointed and have £40 or £50 for his paines yeerely, giving good security for his trust.
9. The remainder of the yeerely contribution unspent towards the necessary charges about the new company to be laid upp for a foundation of building new pesthouses or enlarging the old one with additions of more roomes & more meanes.
10. Any of the new society dying, another to bee putt in his place by the Masters of the profession of the party deceased.
11. It were alsoe to be expected and wished That the Bishopp of the dioces should during the Infection appoint Ministers to visitt the Infected.

One objection made by a worthy Gentleman of the house of Commons concerning an Inconveniency in case these orders should stand answeared.

Hee saith that the very men of the society will bring Infection and spread it further by their going foorth and walking in the throng among those that are cleene of Infection.

I Answeare, First, that though it were graunted they should spread some Infection, yet that little evill will not counterbalance the great benefitt that they may affoord by visiting all those that are infected.

Secondly, though these men sett apart for that service were not restrayned to resort to any but the Infected and should bee shunned by none, yet they should bee an occasion of lesse evill and Infection then hitherto it hath happened by all Phisicions that are resident within the 122 parishes. For there is hardly one of them that sometimes or other within the space of one Month bee not visiting some Infected of the plague, being called to him upon wrong Informations, yet none of all these Phisicions doe keepe themselves afterwards from visiting their friends and other patients: And whoe knowes not that few and certaine persons, only imployed to visitt the Infected, will not, by resorting or being resorted, bee an occasion of spreading soe much the Infection as Two Hundred other Phisicions about London might doe by going but each of them once in a Summer to an Infected house. This will further appeare

by declaring Two maine benefitts which follow of having but few and certaine number of men to visitt the Infected, As other populous Citties beyond sea find daily by experience. The one is that all other phisicions shalbee freed from endangering themselves and others, None of the Infected being like to bee soe unadvised as to seeke helpe of others but those that are knowne to bee sett apart for their service. The other is that these men, being butt few in number and noted to resort Infected places, they wilbee more watchfull to visite none but the Infected. And they that are not Infected wilbee more carefull and sooner shunne them than they might heretofore avoid the company of any Phisicion who may bee came newly from an Infected house. But there is little feare that they bee cause or occasion of spreading the Infection If they doe but observe that they are tied under a penalty or fine to goe to noe house but Infected.

[On verso of second leaf, superscription]

20 No: 1641. Dr. Moulin.

Louis Du Moulin, M. D., Leiden, Cambridge, and Oxford.

A biographical note.

Louis Du Moulin was born on 25 October 1606, the third son of a celebrated French protestant minister, Pierre Du Moulin (1568-1658), and his first wife, Marie de Colignon. Louis' elder brothers were Pierre, who became an Anglican clergyman and a staunch Royalist, and Cyrus of whom little is known. Cyrus seems to have lived chiefly in Holland; it is possible that he was the third son and Louis the second.

Louis matriculated at the University of Leiden on 8 July 1627 "aged 21," and proceeded to the M. D. degree on 23 January 1630 with a thesis *De morbo acuto*.[1] He seems to have come at once to England, for Gilbert Primerose, the eminent Franco-Scottish presbyterian minister, met him in London in March. On 22nd/12th March 1630 Primerose wrote to André Rivet and mentioned meeting Pierre Du Moulin the younger "with his brother the doctor of medicine." Primerose gives a satirical account of Pierre's migration from the presbyterian to the episcopal ministry, because he need only preach once a month, read morning and evening prayer, and hear the catechism: "il fuit le labeur."[2]

[1] R. W. Innes Smith: *English-Speaking Students of Medicine at Leyden*. Edinburgh, London: Oliver and Boyd, 1932.

[2] J. Pannier: *Bulletin de la Société de l'Histoire du Protestantisme français*, 1911, s. 5, 9: 413.

The brothers had an early connexion with England, because their father, Pierre Du Moulin the elder, had spent several years here in close contact with the court of King James I, though most of his long and distinguished ministry was in France. He first came to England in 1588 as a young man of twenty and spent about four years here, acting as tutor and companion at Cambridge to the young Earl of Rutland. After a period at Leiden, Pierre Du Moulin became one of the leading Huguenot ministers in France. King James took notice of him in 1614, when he had defended the King against his French Roman Catholic critics. The King summoned him to London in 1615 and heard him preach at Greenwich on 13 June. He was rewarded with a prebendal stall at Canterbury but left England after only three months; the prebend was later conferred on his eldest son. When the elder Du Moulin was president of the Huguenot Synod of Alais in 1620, the English Ambassador, the famous Lord Herbert of Cherbury, suggested that he should exhort King James to take up the cause of his son-in-law, the King of Bohemia. Du Moulin came again to England at King James's request in 1623 and stayed till the King's death in 1627. This time he was rewarded, in 1625, by a Welsh rectory, Llanarmon in Yale, Denbigh; this rectory similarly was continued afterwards to his eldest son. Subsequently he lived in France, chiefly at Sedan, where he was a professor at the Huguenot academy. He died there aged ninety on 10 March 1658-9.

His two sons, Peter and Louis, took opposite sides in the divided England of their time. Peter, as I said above, became a clergyman in the Church of England. He was sequestered from his Yorkshire living in 1656 under Cromwell's rule, but was incorporated D. D. at Oxford the same year, being already a D. D. of Leiden. He had published anonymously a vindication of the murdered King, *Clamor sanguinis regii*, but he remained friendly to the French Calvinists and defended them against High Church critics. His life as a Canon of Canterbury does not concern us, apart from the contrast it presents to his brother's life.

Louis was a convinced and outspoken presbyterian. He was also a republican and reaped the benefit of this in appointment to a professorship at Oxford under the Commonwealth. After being forcibly retired at the Restoration he continued his religious controversies, worshipping with the non-conformists and writing in their defence.

He was incorporated M. D. at Cambridge, that is to say he was admitted to the equivalent of his Leiden degree, on 10 October 1634, and similarly incorporated M. D. at Oxford on 14 July 1649, having been

appointed Camden Professor of Ancient History in 1648 by the Parliamentary Committee for the University.

Before his appointment to the Camden chair Louis Du Moulin presumably practised as a physician, since he was licensed by the College of Physicians in London on 7 February 1639/40. The discovery of the present manuscript of 1641 is welcome evidence of his interest in medical matters, for nothing has been known hitherto about his medical interests or activity. In the same year, 1641, he began the long series of controversial religious writings which he continued at intervals till the end of his life nearly forty years later; twenty-three controversial books and pamphlets by him are known. Apart from his Leiden thesis, this manuscript provides the only direct evidence of medical work; his only other writing which is not concerned with religious controversy is his inaugural lecture as professor of ancient history.

Louis Du Moulin was naturalised as an Englishman in 1657; his name heads the list of denizations of 28 June 1655 and the list in the naturalisation Bill of 9 October 1656, which passed the House of Commons only on 8 July 1657 and was approved by the Protector the following day.[3] He had petitioned the Protector in 1654 for arrears of his father's pension of £100, and payment of it had been ordered in December 1654.

At the Restoration in 1660 the Royal Commissioners for the University removed him from his chair at Oxford. He retired to Covent Garden, Westminster, where he continued for the remaining twenty years of his life, busily engaged in controversy with a number of Huguenot and Anglican divines, including his brother Peter. Presumably he earned a living by the practice of medicine, but there seems to be no evidence about this. Anthony Wood says that he was "a cross, ill-natured man; a fiery, violent, hot-headed Independent."[4] At the end of his life under the tolerant influence of Gilbert Burnet he retracted his personal attacks on Anglican churchmen. Louis Du Moulin died on 20 October 1680, five days before his seventy-fourth birthday, and was buried at his parish church, St. Paul's, Covent Garden.

[3] W. A. Shaw: *Publications of the Huguenot Society of London.* Vol. XVIII, 1911, pp. 68, 70.

[4] A. à Wood: *Athenae Oxonienses.* 2nd edit., London: Knaplock, etc., 1721, vol. I, Fasti p. 74.

Brief accounts of Louis Du Moulin will be found in: D. C. A. Agnew: *Protestant Exiles from France.* 2nd edit., London, 1876, vol. 3, pp. 119-120. W. Munk: *The Roll of the Royal College of Physicians.* London, 1878. *Dictionary of National Biography,* a memoir by J. G. Alger. His English publications are listed in Wing's *Short Title Catalogue 1641-1700.*

MEDICO-HISTORICAL NEWS AND ACTIVITIES

CORRESPONDENCE AND REPORTS

W. W. FRANCIS
1878-1959

Dr. William Willoughby Francis was born in Montreal, 2 April, 1878. The family later moved to Toronto, and with his five brothers and three sisters he grew up to school age there. Their mother was a first cousin of Dr. William Osler, who looked upon the children as his nieces and nephews.

Educated at Trinity College School, Port Hope, where he laid a firm foundation for his subsequent attainment as a Latinist, Francis then entered the Johns Hopkins University, where he studied both arts and medicine. He received the A. B. degree in 1898, the M. D. in 1902. Two years of interneship at the Royal Victoria Hospital, Montreal, were followed by another year in Baltimore as a Fellow in Pathology. This was, in a sense, the end of a great era, for Osler was spending his last year at the Hopkins. Next for Francis came a *Wanderjahr*. For one, two, or three months at a time he studied paediatrics in London, Berlin, Vienna, Paris, and again London.

In November 1905 he began practice in Montreal. Concurrently, from 1907 to 1911, he was a Demonstrator in Pathology at McGill, assisting Dr. Maude Abbott. Soon after his return to Canada he suffered a pleural effusion. In January 1911 apical pulmonary tuberculosis was diagnosed, and he was forced to give up his practice. He remained under treatment at Ste. Agathe for about eighteen months and made a good recovery. From 1912 to 1915 he was Assistant Editor of the *Canadian Medical Association Journal* and Secretary-Treasurer of the Canadian Medical Association. In 1915 he went overseas with No. 3 Canadian General Hospital (McGill) which he served as Registrar, succeeding Dr. Jonathan C. Meakins. After a brief return to Canada in 1919 for demobilization, he found himself once again in England. This was shortly before Sir William's death, which occurred 29 December, 1919.

An interval of less than two years was spent in Geneva as editor of all four editions of the *International Journal of Public Health*, published by the League of Red Cross Societies and printed in English, French, Italian, and Spanish. On 14 March 1921 he married Miss Hilda Colley. When the journal ceased publication, the Francises went back to England, crossing the Channel only a few days before the birth of their daughter, Marian, who claims Oxford as her native city. From 1922 to 1929 Bill was occupied in the compilation of the *Bibliotheca Osleriana*. He then re-crossed the Atlantic with eighty-eight huge packing cases of Osler's books. The Osler Library at McGill was officially opened 29 May, 1929. For the next thirty years he presided as Librarian. The photograph which accompanies this essay shows him at his desk (which was, of course, Osler's) on or about the thirtieth anniversary of the opening.

Phot. by George Pickett

W. W. FRANCIS

In early life, Francis suffered from tuberculosis. In his later years he underwent a series of attacks of coronary disease. He survived five of them. The sixth killed him, on 10 August, 1959. Disc lesions had given him intermittent pain for many years. Despite all this, he enjoyed life thoroughly. He was consistently cheerful, characteristically gay. Medical students, doctors too, testified to the tonic effects of a brief visit to the Osler Library.

The *Bibliotheca Osleriana* must remain the principal monument of its chief and final editor. The title-page asserts, quite properly, that the book is the work of Sir William Osler. The amenities of collecting were Osler's, the library of course mirrors Osler's taste, and many of the obiter dicta are quoted from his notes on the fly-leaves and inserts. But how much this leaves out of account! R. H. Hill has told the story of the compilation of the Catalogue, on which he and Archibald Malloch, assisted by Leonard Mackall, laboured for so long; and John F. Fulton, from the viewpoint of "a somewhat prejudiced observer," has centered the story on W. W. F., whose seven-year labour completed the task.[1] The annotations and technical descriptions finished, there remained the proof-reading, the addenda, the index, the introduction and the preface. Proof-reading, as W. W. F. performed it, was a stupendous job in itself.

Dr. Francis was averse to having anything to go to the Press until he himself had verified every comma on every card. His corrections in proof were numerous and disturbing to the printers; they, however, were equally exasperating to him, and each correction strengthened his own conviction that nothing must pass for the press without his personal verification. Months passed, the Press meanwhile clamoring for cards, but Dr. F. refused to send them until he saw fit. Some felt insulted that their work was not allowed to stand, but Hill took a broader view. Malloch's letters imploring dispatch rested on the consulting room table unanswered. Lady Osler was beside herself and at times could seem to talk about little else—this despite letters from Dr. Cushing urging her to let the careful scholar set his own pace. Still Dr. Bill refused to be moved or hurried and he would often remark casually to a few who were sympathetic that he had never done anything with his life, his opportunity to accomplish something worth while had now come, and he intended to make the best of it. Hurry meant inaccuracy, and everything must be sacrificed to his ideal.

LeFanu has remarked that the Catalogue has its personal idiosyncrasies ("Osler was not made in everyman's little mould") and contains much that a rigorous bibliographer might have omitted, though he does not wish the superfluities away, and in the opinion of many of its admirers these "extras" constitute the book's greatest charm. Nor are all of them the work of Osler. I invite special attention to a delightful example of Franciscan humour, which springs, it will be noticed, from Franciscan meticulosity. It had proven difficult to decide, among conflicting authorities, the date of the death of Francesco Redi. Hence the following comment: "Death is almost a habit with Redi—in the books of reference. He died, perhaps for the first time, in 1676 . . . again in 1694 . . . and then more frequently. Autopsied in 1696, he was found dead in March 1697 and made his will the

[1] L. G. Stevenson, H. E. MacDermot, E. H. Bensley, eds.: *W. W. Francis, Tributes From His Friends*, Montreal, 1956. The quotations from LeFanu and Archibald are also drawn from this book.

following December . . . His final dissolution occurred in 1698 . . . and the Crusca Academy held a memorial meeting in 1699." What other work of reference discovers such gems as this?

LeFanu remarks further that the arrangement of the Catalogue is often arbitrary, "though how admirable is the concept of the 'Bibliotheca Prima'!" W. W. F. did not share even this qualified admiration of Osler's singular arrangement of the Library's contents, which he always regarded as a great man's crotchet. He defended it without enthusiasm and would have preferred it otherwise. He thought its difficulties were largely overcome, however, by the fullness of the index. In this, I think, he deceived himself, for his own detailed knowledge of both Library and Catalogue enabled him to distinguish readily, as ordinary mortals cannot, between "Secunda" and "Biographica," for example, by the range of the item numbers. For most of us the famous index, accurate to the last degree, is nevertheless frequently exasperating. Perhaps the pressure which was finally brought to bear on W. W. F. to finish his interminable labour deprived him of the opportunity to introduce a greater number of sub-headings, but this I doubt. I do not believe that he ever acknowledged the need for them. As far as he personally was concerned, the need hardly existed, but for most of us, facing a solid paragraph of twenty-five or thirty item numbers, there is no way to distinguish the place of an original work from some casual reference to the author's name—and in so chatty a volume as the *Bibliotheca Osleriana* casual references are numerous. Only 750 copies of the book were printed; it is now hard to find and commands a substantial price. When the time comes to reproduce it photographically, two changes should be made. The errors in the body of the book (almost all of them, I believe, discovered by W. W. F. himself) should be corrected in the margins; and the index should be forced to confess, by starring, underlining, or circling, which numbers indicate an author's writings as embraced in Osler's collection and which the biographical or critical works which are concerned wholly or chiefly with that author, leaving the undifferentiated numbers to take care of cross references and side issues. This would no doubt mar the appearance of the page, but short of resetting it appears now to be the only way to make Osler's adjuration, "Consult the Index first" a truly reasonable and helpful behest.[2]

It is a great book—the record of a happy lifetime of collecting, informed by the highly personal taste and opinion of Osler, enriched by the scholarship of Hill, Malloch, Mackall, and Francis. It was Francis, above all, who made it what it is, an accurate work of reference, oddly and delightfully combined with paragraphs of agreeable book talk. The effect is surprising. It is as if the apples and oranges of a school Arithmetic had the look, the feel, and the scent of real fruit, as if a tarry Trade Wind sprang from the pages of a Geography, or the shouts and trumpets of battle from a manual of historic dates. These old medical books, some of them at least, are unaccountably alive. It occurs to the Catalogue browser that they are not merely *rariora*, interesting bibliographical specimens, *objets d'art*; that they were written and published by real men in real life, with definite objects, under specific circumstances, and now and again with definable results. They were

[2] McGill University now has in hand the task of reissuing the *Bibliotheca Osleriana* by photo-offset, with corrections as indicated.

meant not merely to be collected but to be *read*. "His besetting sin," writes Fulton of W. W. F. in the Oxford years, "was reading ahead in every book he took down. Having found what he wanted bibliographically, the lure of the printed page led him always onwards. He had no idea of time, and if the text of some old medical work interested him, he would be likely to retire at three or four in the morning."

What he liked best, of course, was the human rather than the strictly medical element in what he read. A warm admirer of Chaucer, he had a robust Chaucerian interest in randy human nature, freckled, shirtsleeved, forgetting its company manners, "caught out" or "found in," homely, happy, off guard, riding high or grubbing for pennies. He knew what a bibliophile ought to know of the Nuremberg Chronicle; but what he really loved in its pages was a scandalous anecdote he translated again and again, always with chuckles that rose to his lips as bubbles rise in a sparkling wine. There was this difference—for W. W. F. the wine of life could never go flat.

I said to him once that Osler seemed to me a wise and charming essayist, a good bibliophile, and a gifted biographer, but hardly a rival, as historian, to his fellow Regius, Sir Clifford Allbutt. To my no little surprise, W. W. F. cheerfully agreed. He went further. Osler, he said, unlike Allbutt, was not a historian at all. "He was only interested in the men, the doctors." W. W. F. matched him in this, in scholarship surpassed him. He lacked, however, Osler's strong purpose and the fundamental seriousness which underlay his love of fun. W. W. F. was a fun-loving youngster, even in his eighties. He was unrepentantly facetious. He brimmed over with puns and jokes, limericks and riddles, old stories ever fresh. Anagrams delighted him. When his papers were sorted, hundreds of *Observer* cross-word puzzles came to light. His interest in numbers, never strong, appeared chiefly in his devotion to Latin chronograms. Mrs. Edith Gittings Reid entitled one of the chapters of her book about Osler, "A Child Among Children." Forty years after Osler's death, one of the children was still laughing, still playing the old games with undiminished zest. When W. W. F. ran out of rhymes, he concocted his own. But his chief vocation, his avocation, too, in all his later years, was the writing of letters. Thousands of these are preserved. Some are serious enough; most, I think, impart information. Many show frank and guileless prejudice. A certain testiness is now and again apparent. But by and large they are wonderful confections, spun out of nothing and shining like the sun. He composed them, as he did everything, with the greatest care. Typescripts were almost always amended, supplied with afterthoughts, even references. He considered a page of typing untouched by the pen a sort of challenge, almost an affront. A "clean" MS roused his suspicion. Even a joke, when written down, had to be exactly right.

W. W. F. was self-indulgent within the limits of his taste. He had no expensive habits, had to be persuaded to buy a new suit, detested all forms of liquor (not as a matter of principle but because he loathed the taste of it and said it made him ill) and indulged only in a little candy and an occasional glass of a very sweet wine he called "Chorus Girl." (It amused him that this was a *vin de messe*. Similarly, with gentle good humour which never seemed to give offence, he reproached his French-speaking friends with irreverence—their name for St. Thomas Aquinas sounded so uncommonly like Tomato Can.) No, his self-indulgence had no relation to food or drink, or, indeed, to any of the common luxuries, even the minor ones.

He smoked cigarettes for years but had long ago given them up on his doctor's advice. He couldn't understand why people bothered so much about flowers. His own taste ran to books (he never needed to buy them), to simple games, to easy conversation, to jokes and jollity, and to lying abed in the morning. ("Never mind, Bill," Osler used to say to him in Baltimore, "You'll be in time for the afterbirth!") As for public affairs, he very largely ignored them. Too depressing. Local news of a non-political kind he followed avidly. Princess Grace he found enchanting. Most of modern literature he thought sordid and tiresome. He was repelled by thick, ahistorical novels. His home was adorned with good water-colours, and with photographs and drawings of his friends—Osler, Klebs, Maude Abbot, Colin Russel. There were also pictures of Kipling and Churchill. Toward the end of his life he surrendered, though only partially and with many protests, to television. Music was always an important part of his life.

The late Dr. Archibald, Professor of Surgery at McGill, once wrote to Francis about the Archibald motto, *Palma non sine pulvere*. "But you disprove that general truth, or you prove the rule of the exception, by gaining the palm without raising a dust." As a matter of fact, the palm was awarded with a niggardly hand. Memberships in the Bibliographical Societies of London and Oxford and an appointment as Honorary Consultant to the Armed Forces Medical Library were no more than his due; these honours he cherished, and he was greatly pleased by Honorary Fellowship of the Royal Society of Medicine. Year after year he sat at his desk, tracing references, deciphering manuscripts, pouncing on errors in proofs, and working out the answers to historical questions with endless patience—all for the benefit of the writings of others, of the physicians and historians of two continents. His name appears in a thousand prefaces and notes of acknowledgement. Of these he was justifiably proud. But such acknowledgement seemed to many of his friends, and to mere acquaintances who benefited from his selfless efforts, to be far too meagre. They therefore seized the occasion of the thirty-fifth anniversary of the Osler Society, falling in 1956, to join the students in publishing a volume of *Tributes*, which delighted his heart. In this enterprise the moving spirit was Dr. Harry Ballon.

W. W. F. had a long and happy life. He is survived by his widow, by his daughter, Dr. Marian Kelen, and by a sister, Miss Beatrice Francis of Babbacombe, Devonshire. His many friends, in Canada, the United States, England, and elsewhere, will forever miss his gaiety of spirit. A generation of doctors, graduating from McGill, has carried a touch of Billy, and of Osler, to the ends of the earth.

LLOYD G. STEVENSON

ANNOUNCEMENTS

AMERICAN ASSOCIATION FOR THE HISTORY OF MEDICINE

Thirty-Fourth Annual Meeting: Chicago, Ill., May 18-20, 1961.

The Thirty-fourth annual meeting of the American Association for the History of Medicine will be held in Chicago, Ill., May 18-20, 1961. Dr. Ilza Veith is chairman of the Committee for Local Arrangements.

Members who wish to present papers are asked to send an abstract of not less than 500 words to the chairman of the Program Committee, Professor Charles D. O'Malley (School of Medicine, University of California, Los Angeles 24, California).

Osler Medal

The Osler Medal for 1960 has been awarded to Mr. David Franklin Musto, class of 1962, University of Washington School of Medicine, Seattle, Washington, for his essay entitled: "The Theory of Hereditary Disease of Luis Mercado, Chief Physician to the Spanish Hapsburgs." Honorable Mention was awarded to Mr. George F. Sheldon, a Junior medical student at the University of Kansas School of Medicine, Kansas City, Kansas, for his essay entitled: "Rush and Physick: an Important Medical Friendship."

JOHNS HOPKINS INSTITUTE OF THE HISTORY OF MEDICINE

Gerald J. Gruman, M. D., Ph. D., has been appointed Assistant Professor of the History of Medicine, and Edwin S. Clarke, M. D., M. R. C. P., Instructor in the History of Medicine. Both appointments will become effective as of September 1, 1960. Dr. Gruman is presently holding a Public Health Postdoctoral Research Fellowship at Harvard University which awarded him the Ph. D. degree in the History of Science in June 1960. He received his M. D. degree from the University of Pennsylvania in 1949. Dr. Clarke held a Fellowship at the Johns Hopkins Institute from January to June 1960. Formerly a Lecturer in Neurology at the Postgraduate Medical School of London, Dr. Clarke was Scientific Secretary to the Wellcome Trust, 1958-59.

NATIONAL NEWS

Anatomical Manikins

Dr. Pierre Decouflé (Avenue Clemenceau, Dakar-Sénégal-Fédération du Mali) wishes to inform his American colleagues that he is attempting a comprehensive study of anatomical manikins, i. e. statuettes representing the visceral contents of the opened human body. He would like to get in touch with any colleagues who have already published work on this subject, or who know of public or private collections of such figurines.

History of the Behavioral Sciences

A "History of the Behavioral Sciences Newsletter" has made its (mimeographed) appearance with vol. 1, no. 1, under the date of July, 1960, from Payne Whitney Psychiatric Clinic, 525 East 68th Street, New York 21, N.Y. Eric T. Carlson, M.D., and Oskar Diethelm, M.D., are among the members of the editorial staff. We quote the following passages from the Introduction: "The Newsletter is directed toward all those interested in the history of any of the behavioral sciences, whether they are engaged in specific research, bibliophile activities, or general study. . . . The Newsletter will not be a formal publication; it will change and develop according to the needs of its readers. It will appear irregularly, and (at least at first) it will be sent free of charge. At the moment there are more than 250 names on our mailing list, but most of these are of psychologists and psychiatrists. We therefore urge our readers to furnish us with the names and addresses of any anthropologists and sociologists interested in the history of their fields."

History of the Medical Department, U.S. Army, in World War II

The following volumes, of the proposed 45 volumes for the series, are presently offered for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C.: *Hospitalization and Evacuation.*—*Dental Service in World War II.*—Preventive Medicine in World War II, Vol. II, *Environmental Hygiene.*—Preventive Medicine in World War II, Vol. III, *Personal Health Measures and Immunization.*—Surgery in World War II, *Hand Surgery.*—Surgery in World War II, Vol. II, *General Surgery.*—Surgery in World War II, *The Physiologic Effects of Wounds.*—Surgery in World War II, *Vascular Surgery.*—Surgery in World War II, *Ophthalmology and Otolaryngology.*—Surgery in World War II, *Orthopedic Surgery, European Theater of Operations.*—Surgery in World War II, *Orthopedic Surgery, Mediterranean Theater of Operations.*—Preventive Medicine in World War II, Vol. IV, *Communicable Diseases Transmitted Chiefly Through Respiratory and Alimentary Tracts.*—*Cold Injury, Ground Type.*—Surgery in World War II, *Neurosurgery,* Vol. I.

Missouri

Warren A. Heffron, a second-year student in the University of Missouri School of Medicine, was presented the first annual prize in the recently-established Arthur Rochford McComas Medical History Essay Contest for students in the School of Medicine. The award, carrying a prize of $100, is named after the late Dr. McComas, an alumnus of the university and president of the Missouri State Medical Association in 1922-1923 (*see J.A.M.A.*, June 4, 1960, *173*: 551).

Deaths

Bernard Aschner, M.D., died on March 9, 1960 in New York City. A member of the American Association for the History of Medicine, Dr. Aschner had a lifelong interest in the history of medicine. He is especially known for his modern German edition of the works of Paracelsus and for his advocacy of the preservation of older modes of treatment (*see* this *Bulletin*, 1941, *10*: 260 ff.; 1943, *13*: 291 ff., and 1945, *17*: 269 ff.).

George Urdang, Ph. G., D. Sc. Nat., Sc. D. (h. c.), died on June 27, 1960 in Madison, Wis. A native of Germany, Dr. Urdang had been an honorary member of the American Pharmaceutical Association long before his arrival in the United States in 1938. He was influential in founding the American Institute of the History of Pharmacy with headquarters in Madison whose first Director he became. In 1947 the University of Wisconsin called him to the newly created chair for the history of pharmacy. Dr. Urdang was a scholar of world renown, well known to the members of the American Association for the History of Medicine whose meetings he used to attend in earlier years.

NEWS FROM ABROAD

Pan American Congress of the History of Medicine

The second Pan American Congress of the History of Medicine and first Venezuelan Congress of the History of Medicine will be held in June 1961. Dr. Franz Conde Jahn is president, Dr. José María Llopis secretary of the Congress. All correspondence should be addressed to the Secretariat, Palacio de las Academias, Caracas, Venezuela.

England

The Faculty of the History of Medicine and Pharmacy of the Society of Apothecaries of London, has published its first annual report and list of members, 1959-60. The Faculty will organize the First British Congress on the History of Medicine and Pharmacy on September 29 and 30, 1960, to be held at the Hall of the Society of Apothecaries.

France

Dr. Ernest Wickersheimer, the famous French historian of medicine, celebrated his eightieth birthday. On this occasion the medical faculty of the University of Frankfurt, Germany, bestowed upon Dr. Wickersheimer the degree of *Doctor Medicinae, honoris causa.*

Germany

The German Society for the History of Medicine, Science, and Technology will hold its annual meeting jointly with the Society of German Engineers, Section History of Technology, at Lueneburg, August 27-31, 1960. The theme of the meeting is: "The spread of scientific ideas and methods."

BOOK REVIEWS

RUBEN ERIKSSON. ***Andreas Vesalius' First Public Anatomy at Bologna, 1540.*** An eyewitness report by Baldasar Heseler together with his notes on Matthaeus Curtius' Lectures on Anatomia Mundini. Edited, with an introduction, translation into English and notes by Ruben Eriksson. Uppsala and Stockholm, Sweden: Almqvist & Wiksells Boktryckeri Ab, 1959, 343 pp. Ill. $11.25.

Manuscript lecture notes diligently compiled by students of former times are often to be found in medical libraries. They are usually carefully preserved, but as the hand may not be an easy one to decipher, as they may be dull and uninspired, and as it may be difficult to identify the student or the teacher, they are likely to remain undisturbed and unread. Their contents reflect both the writer and the lecturer, and from the historian's point of view their importance lies in the fact that they preserve a direct link with the latter. This may be a source of information just as valuable as his printed works and may at times supplement them with additional arguments; and perhaps biographical material may be included. The notes of Lister's lectures, outlining the text-book he never found time to write, and the students' notes of the Monroes of Edinburgh presently being investigated, are examples of the rich source material which may be within an arm's reach. However, we must know what we are looking for, and long hours of patient transcription, translation, verification, collateral research, and the use of associated techniques are the price we must pay for our curiosity.

It is fortunate for us that Dr. Ruben Eriksson, Head Librarian of the Karolinska Institutet in Stockholm, possesses these skills, for he has been able to unearth and now publish a most important document from the Royal Library in Stockholm.

It has always been a remarkable yet regrettable fact that, although Vesalius must have taught anatomy to thousands of students, many of whom must surely have made some record of his instruction for their future use, until now no copy of such notes has been discovered. For some years, however, Dr. Eriksson has been working patiently on the lecture notes of a German medical student, Baldasar Heseler (1508 or '09-1567), who attended the lectures on the Anatomy of Mundinus given by Matthaeus Curtius at Bologna in 1540 and the anatomical demonstrations performed by a guest anatomist, Vesalius, in conjunction with them.

Curtius (1475-1542 or '44) was at this time a teacher of theoretical medicine at Bologna, and he enjoyed a high reputation as a physician and lecturer. He conformed to the medical concepts of the Middle Ages in that he asserted the infallibility of Galen and did not always submit to demonstrable anatomical fact. It is understandable therefore that Vesalius, who was 40 years his junior, although subscribing to many of the same doctrines, could not agree on all issues. We are thus greatly privileged to have a first hand description of an episode at the threshold of modern anatomy. It not only throws new light on the two men themselves, but it illustrates the conflict between the old and the new. It adds to, and substantiates, many aspects of our knowledge of Renaissance and late medieval anatomy, as well

as supplying useful details of university medical teaching in 16th century Italy. The main interest, however, centers on Vesalius. The period in his life between the publication of his *Tabulae anatomicae* in 1538 and the *De humani corporis fabrica* in 1543 has always been of great interest because of the changes which took place in his anatomical thinking and which are indicated by the two works. Thus, any contemporary document dealing with this time of transition is of the greatest value in our appraisal of Vesalius.

Dr. Eriksson gives biographical accounts of Heseler, Vesalius, and Curtius, as well as discussing the *Anatomia Mundini*, the subject of the lectures and demonstrations. He then presents the Latin text and his English translation of the lecture notes side by side. There are detailed reports on twenty-six demonstrations involving the dissection of three human subjects and six dogs. Unlike many writers of lecture notes, Heseler has been able to add atmosphere and colour to his description of the events by giving a lively account of the heated discussions which often and inevitably ensued and by including brief references to the comments and behavior of his fellow students, as well as occasional marginal comments. Dr. Eriksson's translation is accurate and effective, and each demonstration has a number of useful notes, grouped together at the end of the book. There is a list of the works cited by Curtius and Vesalius and also a bibliography of manuscripts and books referred to by Dr. Eriksson. The book has been beautifully produced and is published by the Lychnos Bibliotek in the series of Studies and Sources sponsored by the Swedish History of Science Society.

Dr. Eriksson, who through the generosity of the Wellcome Trust was able to discuss his work with a small gathering of Vesalian scholars in England in October, 1959, has made important additions to our knowledge of several aspects of medical history in making available this unique document. If he has also stimulated us to look again at those dusty volumes of students' lecture notes, his contribution will have been twofold.

EDWIN CLARKE

J. E. SCHMIDT. *Medical Discoveries: Who and When.* Springfield, Ill. Charles C Thomas, 1959, ix, 555 pp. $14.75.

J. E. Schmidt, M. D., President of the American Society of Grammatolators and Chairman of the National Association on Standard Medical Vocabulary, was the author, in 1958, of *Reversicon: A Medical Word Finder*. The book was a clever compilation of medical concepts and ideas, from which a searcher could find a proper medical term. As the name implies, the book was a turn-about or reversal of the usual type of dictionary.

Now, in 1959, Dr. Schmidt has compiled a brave book on *Medical Discoveries: Who and When*, with full names and dates. The ordinary medical writer is slightly hesitant in pinning many of the medical discoveries on a particular individual, because some picayune researcher comes along with the finding that the same condition was discovered or described by someone else at an earlier date. But Dr. Schmidt has bravely had the whole thing set into cold type, and the discoveries are there for all time. If any one of you knows why this union of idea and metal type should not be joined, let him now hold his peace.

In one alphabetic list the compiler has covered everything from Abasia and astasia, first recorded investigation of—to Zymogens, early recognition of. Eponyms are placed under the proper anatomic term, which is just as it should be. For instance, if you are looking for Oppenheim's disease, you are referred to Amyotonia congenita.

On the other hand, more cross references would have been helpful, because you must know what you are looking for, if you hope to find it. For instance, there is one entry under J. A. Sampson, i.e., Ovarian endometriomas, under which we find the date of 1921, and "Known as Sampson's implants, endometrial implants, or endometriosis." But no reference to this condition appears under Endometrium or Endometriosis. And yet another reference to Sampson turns up if you happen to look under Chocolate.

Let us see what we can find regarding the Bell-Magendie discovery and the resulting controversy. On page 53 we find, "Bell-Magendie law of spinal nerve roots . . . See under Motor function of anterior roots of spinal nerves." Nothing appears under Magendie. Page 307 gives, "Motor function of anterior roots of spinal nerves, confirmation of, François Magendie, French physiologist, 1783-1855, confirmed the findings of Charles Bell that the anterior roots of the spinal nerves are motor in function. Reported in 1822. Known as Bell-Magendie law." This entry is immediately followed by "Motor function of anterior roots of spinal nerves, first demonstration of, Charles Bell, Scottish physician, 1774-1842, gave the earliest demonstration, in 1811, that the anterior roots of the spinal nerves are motor in function. Known as Bell-Magendie law." In 1911 A. D. Waller wrote that "there is no escape from the conclusion that Bell's claim as a discoverer was a carefully fabricated claim and that the discovery of the distinction between motor and sensory nerves belongs entirely to Magendie." And in a personal communication in 1938, the biographer of Magendie, J. M. D. Olmsted, says "A fair-minded critic must admit that the changes were made with the definite idea of strengthening Bell's position. I fail to see how any other word than dishonesty can be applied to such manipulation of a text which still purported to be the original." [1]

[1] The reference is to the purported "republication" by Bell in 1824 of his privately printed and little known 1811 pamphlet.

So now you see how brave Dr. Schmidt really is in his latest book.

We are glad to observe that Dr. Schmidt has done right by Oliver Wendell Holmes and Ignaz Philipp Semmelweis in relation to puerperal fever, but the repetition of the same information on the following page under the heading of Puerperal sepsis seems a bit secretarial.

We wish that the compiler had brought some of his entries a little closer to the present time, and thereby had made them more useful. Medical jurisprudence has only one reference, that one of 1602. We also wish that more detailed references than simply a date had been provided.

In spite of these wishes, we now welcome a ready reference to the recent landmarks in medical progress.

Except for a somewhat weak spine (an important point in a reference work which will be much handled), the publisher has done a fine job. The format is excellent, the type is large and clear (an important point for us oldsters who seem principally interested), and the price is superb (which is as it should be).

EMERSON CROSBY KELLY

RICHARD H. SHRYOCK. *The History of Nursing.* An Interpretation of the Social and Medical Factors Involved. Philadelphia and London: W. B. Saunders Co., 1959. x + 330 pp. $5.00.

Dr. Shryock's interesting and highly readable book might appropriately have been entitled, "Historical Relations of Medicine and Nursing," since it surveys not only the history of nursing and many of the main events in the evolution of medicine, but aims to present the story of nursing in close relation to its social and scientific backgrounds. These two main strands of history are presented against a background of political, social, scientific, and religious history from pre-Christian times to the present. Thus placing nursing in its social setting gives a more comprehensive understanding of its place in world history.

The contents are arranged within a chronological framework and include traditional topics, as well as, refreshingly, some new approaches. Some chapters are devoted exclusively to medical developments, others to nursing evolution, political and social history, scientific advances, and some to all of these. The narrative illustrates that while medicine and nursing have been interrelated, they have not always followed the same path, each responding to contemporary conditions.

In writing of primitive groups, the writer makes a distinction among three elements which influenced the care of the sick, namely, naturalistic, religious, and occult. He points out that these peoples did not always make distinctions between priests and medicine men; that the same individual sometimes served in both capacities; and that healing practices were frequently carried out by the whole group.

The main outlines of the healing arts among some ancient civilizations are retold. Among these the only one known to have had a special group of nurses was India, and this is thought to have been brought about by the establishment of hospitals. These nurses were men, and this fact suggests the query as to whether only men were admitted to hospitals.

The influence of Christianity on the evolution of nursing was to stimulate its growth, but Christianity did not affect the development of medicine in the same way. Medical practice had been anticipated in the cultures of Greece and Rome and had suffered a decline after the third century before Christianity became dominant in the Roman Empire. Its improvement was related to the growth of science in the universities, chiefly after 1100 and more markedly after 1500. Conversely, the "Dark Age" of nursing is given as from 1600 to 1850, and is associated with the decline of hospitals brought about by the secular trend in social life, nursing being negatively affected by medical practice. Medicine responded to such new inventions as the microscope and other innovations useful in the practice of doctors. Nursing improved as the need for better care of patients became apparent to physicians, philanthropists, and the public.

In both England and America nursing conditions in the seventeenth and eighteenth centuries presented a gloomy picture. There were exceptions to this, however, as is shown by the nursing in hospitals established specifically for the care of the sick, such as the Pennsylvania Hospital and the New York Hospital. The fact also that the English philanthropist, John Howard, was disturbed by the poor conditions which he found in the hospitals which he visited in the eighteenth

century, indicates that better ones existed. Other beginnings of better nursing were noted in the founding of the Sisters of Charity, the Kaiserswerth Deaconess Order, and the Anglican nursing orders.

In the history of the interrelation of medicine and nursing in England and America, the writer reviews the influence of Florence Nightingale, the founder of modern professional nursing service and education, not only on these two fields throughout the world, but also on nursing in the army and on medical education. He surveys briefly some of the adaptations of British nursing in America in the 1870s. The concluding chapters deal briefly with American nursing after 1870 and some of the existing problems and the policies and plans developed to meet them.

Dr. Shryock suggests that historical perspective may be of service in evaluating present-day nursing. He credits three factors with being influential in the development of nursing, namely, patriotism (military nursing), humane feelings (charitable institutions), and evolving medical achievement. Nursing is still, in the mid-century, in his view, a field in flux, and the complexity of its problems is matched only by the value of its achievements. Historical perspective may help in striking a balance between extremes in attitudes regarding the achievements in nursing and its present difficulties. In his opinion there is no question that nursing on its upper levels (these are not defined) has greatly improved during recent generations, and that in no country is this more obvious than in the United States. This has resulted in part from the efforts of devoted women, but after 1870, from the realization that a new type of medical science demanded better nursing, and from "blending of humane and scientific goals [which] enabled nursing to adjust to medicine and so serve the needs of modern society for medical care."

In conclusion the writer analyzes the professional status of nursing and declares that he is not sure to what extent the upper levels of nursing can attain full professional status; that there is no doubt that nursing has been moving *toward* such status. Well prepared and competent nurses are essential to society, and in the humane tradition, their opportunities and services may well be greater than those of physicians. Whether this implies that professional nursing is not entirely a dependent profession but may also have a function of its own apart from its relation to the medical profession is not clear.

ANNE L. AUSTIN.

THOMAS NEVILLE BONNER. *The Kansas Doctor*, A Century of Pioneering. Lawrence: University of Kansas Press, 1959. xiv + 334 pp. Ill. $5.00.

Written in an extremely attractive fashion, this chronicle of the history of medicine in Kansas paints a vivid and moving picture of the evolution of the Kansas physician against the changing background of the local and national political scene. Similar stories could probably be told concerning pioneer physicians and their progeny in many of the states, but the role of early Kansas doctors in the political life of their community must be somewhat unique. The author points out that, "The first governor of the state was Dr. Charles Robinson, the first lieutenant-governor Dr. Joseph Root, and the first secretary of state Dr. John W. Robinson—

eloquent testimony to the role of doctors in the shaping of young Kansas." The majority of early Kansas doctors, however, are portrayed primarily as practitioners of the healing arts and as pioneers.

Throughout the six chapters, the style is engaging and easily read, and although meticulously documented, the text itself is devoid of distracting references which are appended in a sixteen page section of references and an eleven page list of bibliographical sources.

The chapter dealing with the development of public health measures during the period 1904-1923 is largely the romantic story of the exploits of Dr. Samuel Crumbine. The intrepid practitioner from Dodge City marches through Bonner's pages armed with fly-swatter (a Kansas invention) and posters against filth and contaminated food to bring Kansas to the position of first in public health and statistically the healthiest state in the nation. William Allen White, editor of the *Emporia Gazette* dubbed him the "St. George of the Pure Food Crusade" and referred to "Dr. Crumbine and his Light Brigade" attacking the unsanitary and adulterated food and drinks of the Ringling Brothers Circus.

The evolution of the University of Kansas Medical School from the several woefully inadequate medical schools at the time of the Flexner Report is woven into the entire story. The appraisal of the roles played by Dr. Franklin Murphy, Dr. Karl Menninger, and others in the "Medical Renaissance" following World War II seems fair and accurate to this reader.

The reviewer, a Kansan by birth and education, suffers feelings of shame and regret in reading again of the political fiasco of the 1920's which led to the resignation of Dr. Crumbine and nearly wrecked the medical school. That Kansas should nurture and almost elect as its governor such a monstrous quack as Dr. John R. Brinkley is also a blow to one's pride in his heritage.

This book can be read with profit and pleasure by any person with a slight interest in medicine, and should be required reading for every Kansas physician and medical student.

MAX S. ALLEN

WALTER A. WELLS. *A Doctor's Life of John Keats.* New York: Vantage Press, Inc. 1959, 247 pp. Ill. $3.95.

Dr. Wells has written a popular account of John Keats as apothecary apprentice, medical student, melancholiac, and tubercular, and thus has dealt with those features of the poet's life that might particularly attract the attention of a physician. We are told of the way Keats prepared himself for a career in medicine, a career which, according to his genius, he managed to forestall. Although at Guy's Hospital he had the engaging figure of Astley Cooper before him, he kept faith with Spencer's Muse, and the surgery and dissecting room failed to tempt him beyond the requisites of a good student. The rest of the account has mainly to do with the disease that ended the few but phenomenally productive years that remained. Dr. Wells sees in the life of Keats another example of genius touched by melancholia and disease, and is led in a final chapter to consider the qualities of genius and to speculate on its nature.

Dr. Wells has written because he believes that a re-examination of Keats, or any other man of genius, in the light of recent medical achievements will yield new interpretations of his life and work. New interpretations must go on, needless to say, but the reviewer remains skeptical of this particular genre of historical writing.

WILLIAM J. CATHEY

THE BULLETIN RECENTLY RECEIVED *

Antonio Hernandez Alcantara. *La obra tocologica y pediatrica de Nuñez de Coria.* Salamanca, 1960, 32 pp., Ill. (Estudios de Historia de la Medicina Española, Universidad de Salamanca, nueva serie, Tomo II, Núm. 2.)

Ricardo Archila (Editor). *Bibliografia medica Venezolana,* tercera edicion 1952-1958. Caracas: Imprenta Nacional, 1960, xl + 494 pp.

William Beaumont. *Experiments and Observations on the Gastric Juice and the Physiology of Digestion.* With a biographical essay "A Pioneer American Physiologist" by Sir William Osler. New York: Dover Publications, Inc., 1960, xl + 280 pp., Ill., $1.50.

Luigi Belloni. *La scuola ostetrica Milanese dai Moscati al Porro.* Per il VI° Congresso della Società di Ostetricia e Ginecologia del Mediterraneo Latino. Milan, 1960, 87 pp., Ill.

Brompton Hospital Reports. Vol. xxviii, 1959. London: Lloyd-Luke (Medical Books) Ltd., xii + 258 pp., Ill., 15 shillings.

C. N. B. Camac (Editor). *Classics of Medicine and Surgery.* Collected by C. N. B. Camac. New York: Dover Publications, Inc., 1960, x + 435 pp., Ill. $2.25. (Formerly titled: *Epoch-making Contributions to Medicine, Surgery and the Allied Sciences.*)

Theodore Cianfrani. *A Short History of Obstetrics and Gynecology.* Springfield, Ill.: Charles C Thomas, 1960, xvi + 449 pp., Ill. $12.50.

Logan Clendening (Editor). *Source Book of Medical History.* Compiled with notes by Logan Clendening. New York: Dover Publications, Inc., 1960, xiv + 685 pp., $2.75.

Zachary Cope. *The Royal College of Surgeons of England,* a History. Springfield, Ill.: Charles C Thomas, 1959, xii + 360 pp., Ill., $13.50.

Paul Diepgen. *Unvollendete.* Vom Leben und Wirken frühverstorbener Forscher und Ärzte aus anderthalb Jahrhunderten. Stuttgart: Georg Thieme Verlag, 1960, vi + 223 pp., Ill., DM 16.80.

History of the Long Island College Hospital, Long Island College of Medicine, and the State University of New York College of Medicine at New York City. Alumni Association Highlights 1880-1955 and Biographies of Graduates 1900-1955. [New York, 1960] xv + 448 pp., Ill.

* The *Bulletin* reserves freedom of decision as to the publications to be listed in this section. Items received, other than those assigned for review, are ultimately incorporated into the collection of the Institute of the History of Medicine.

Lew A. Hochberg. *Thoracic Surgery Before the 20th Century.* New York, Washington, Hollywood: Vantage Press, Inc., 1960, 858 pp., Ill., $15.00.

Emmet Field Horine. *Biographical Sketch and Guide to the Writings of Charles Caldwell, M. D. (1772-1853).* Brooks, Ky.: High Acres Press, 1960, viii + 155 pp., Ill., $10.00.

Clifford Morson (Editor). *St. Peter's Hospital for Stone 1860-1960.* Edinburgh and London: E. & S. Livingstone Ltd., 1960, viii + 64 pp., Ill., $5.00. (The Williams & Wilkins Co., Baltimore, exclusive U. S. agents.)

Fred B. Rogers. *Help-Bringers: Versatile Physicians of New Jersey.* New York, Washington, Hollywood: Vantage Press, 1960, 125 pp., Ill., $2.95.

Rafael Sancho de San Román. *La medicina y los medicos en la obra de Tirso de Molina.* Salamanca, 1960, 70 pp., Ill. (Estudios de Historia de la Medicina Española, Universidad de Salamanca, nueva serie, Tomo II, Núm. 1.)

Rafael Sancho de San Román. *La obra psiquiátrica de Giné y Partagás.* Salamanca, 1960, 79 pp., Ill. (Estudios de Historia de la Medicina Española, Universidad de Salamanca, nueva serie, Tomo II, Núm. 3.)

Jerome M. Schneck. *A History of Psychiatry.* Springfield, Ill.: Charles C Thomas, 1960, ix + 196 pp., Ill., $5.50.

W. Stanley Sykes. *Essays on the First Hundred Years of Anaesthesia,* Volume I. Edinburgh: E. & S. Livingstone Ltd., 1960, 171 pp., Ill., $7.00. (The Williams & Wilkins Co., Baltimore, exclusive U. S. agents.)

Herbert Thoms. *Our Obstetric Heritage,* the Story of Safe Childbirth. Hamden, Conn.: The Shoe String Press, Inc., 1960, xii + 164 pp., Ill., $4.75.

U. S. Department of Health, Education, and Welfare, Public Health Service. *Film Catalog,* June 1960. xi + 66 pp. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., 50¢.

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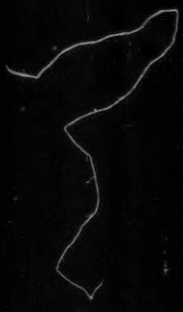
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